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The purpose of the *Bulletin* is to serve as a means of communication between the Department of Defense (DOD) and its authorized agencies and defense contractors and other business interests. It will serve as a guide to industry concerning official policies, programs and projects, and will seek to stimulate thought by members of the defense-industry team in solving the problems that may arise in fulfilling the requirements of the DOD.

Material in the *Bulletin* is selected to supply pertinent unclassified data of interest to the business community. Suggestions from industry representatives for topics to be covered in future issues should be forwarded to the Business & Labor Division.

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Standardization

The Answer to the Fleet Spare Parts Dilemma

Captain Carl B. Ihli, USN

THE U.S. Navy is attempting to eliminate the influx of an unnecessary variety of individual items into its inventory with the application of a Component/Equipment Standardization Program, managed by the Office of the Director of Standardization and Configuration Management under the Deputy Chief of Naval Material (Logistics Support).

Under the program, the Navy emphasizes multi-year procurement of larger blocks of identical equipment, incentive clauses for using a larger number of standard components/equipments, and life cycle cost considerations in procuring hardware systems.

Effort is being made to re-use in new design those reliable in-service components already supported in the Military Supply System by a range of spare parts.

Although all the Naval Material Command's systems commands (Air, Electronics, Facilities Engineering, Ordnance, Ships and Supply) have been directed to pursue the program, deepest analysis to date has been in the area of ships parts (hull, mechanical and electrical).

This article will be devoted to hull, mechanical and electrical shipboard equipment and their repair parts, and they will be identified as:

"S" Cog—Under Naval Ship Engineering Center management control.

"H" Cog—Under Ship Parts Control Center management control.

By the Numbers

Unless the component/equipment spare part has a Federal Stock Number or manufacturer's identification, model, or part number, the logistics support comes to a halt until applicable numbers are determined in the hull, mechnical and electrical master technical records (Figure 1). All Allowance Parts Lists (APLs), regardless of revisions, are retained for five years to ensure available data to verify contract range and depth of repair parts.

The Ship Parts Control Center, Mechanicsburg, Pa., as the inventory control point, manages currently a total of 291,000 items, of which 180,000 items are "H" Cog in support of hull, mechanical and electrical components/equipments. Since the establishment of the Defense Supply Agency (DSA), approximately 125,000 items have been transferred to DSA from the Ship Parts Control Center and more are due for transfer. Close liaison between the supply activities is required to meet the needs of the fleet. Migration to DSA continues for "H" Cog repair parts and, conversely, many "S" Cog components/equipments are being transferred from the Naval Ship Engineering Center to the Ship Parts Control Center. As the inventory control point repair parts supply management at the Ship Parts Control Center is reduced, the complete equipment supply responsibilities increase.

SPCC **MASTER TECHNICAL RECORDS**

1) TPCR	(TECHNICAL PARTS CHANGE RECORD)	7,500,000 CARDS
2) DECK "A"	(ITEM RECORD CROSS OF PART NOS. TO COMPONENT)*	3,280,300 CARDS FOR 1,723,240 RECORDS
3) DD 146	(ITEM IDENTIFICATION CARDS)	1,059,000 CARDS
4) DECK "D"	(COMPONENT CHARACTERISTICS)*	288,880 CARDS FOR 220,000 COMPONENTS
5) DECK "E"	(SHIP APPLICATION OF COMPONENTS)*	690,000 CARDS FOR 220,000 COMPONENTS
6) PRINTED APLs	(ALLOWANCE PARTS LIST)	201,100 COMPONENTS

*ON TAPE

Figure 1.

Old Ships

Figure 2 shows the age of active fleet ships. By activation action from the Reserve Fleet over the past two years, the percentage of active ships, built in World War II, has increased from 54 percent to 59 percent of the total fleet population. The age of the ships has a major impact on the supply support problem.

Auxiliary and amphibious ships have proved problematical during their activation. Examples of problems encountered are:

- Manufacturer of the equipment is no longer in business, and the time element requires the repair parts to be manufactured by the shipyard.
- Component was not installed in any active fleet ships and there were no supply demands for equipment repair parts during the ship's inactive (reserve fleet) life. Accordingly, all parts had been disposed of in the past to reduce stock inventories at inventory control points.

The overall repair part problems of the World War II ships, as well as ships built after World War II, can best be stated in the following sequence showing corrective actions:

- **Manufacturer is no longer in business.** An attempt is made to obtain another source, by competitive bid, to manufacture the repair parts. Some success is achieved only if the fleet population indicates continuing need and warrants cost from the manufacturer's viewpoint.
- **Manufacturer is in business but no longer manufactures the component or repair part.** If sales were sufficient, the manufacturer would still be making the repair parts. This problem, prevalent in procuring low-population items for the Fleet, must be answered by finding another source to manufacture these repair parts or replacing the component. In many instances, operational requirements of the ship necessitate local shipyard manufacture of the part which consumes valuable time and is more expensive. "Borrowing" from sister ships in the Reserve Fleet has been of immediate help, but this is not a long-term answer.
- **Manufacturer is in business, no longer manufacturing component, but will manufacture repair parts.** Basically, because the buy is not a large-quantity buy, long lead time is involved. Industry readily recognizes an obligation to support its equipment in the Fleet, but small-quantity buys of parts, that interrupt normal production, receive low priority. For example, one company, having many types of equipment installed in critical systems in the Fleet, now has only five percent of its business with the Navy, 30 percent export and 65 percent with commercial industry; only by quantity buys, that support a continuing production line for repair parts, can supply support be effective.

Another prime contributor to the repair part dilemma for old ships in the Fleet is the inherent meaning of the term "old." Some hull, mechanical and electrical equipment failures occur in basic parts that are not considered repair items. This type of "insurance" item is not normally carried in stock. A replacement buy is initiated and long lead time is invariably involved if the equipment is obsolete or obsolescent. A prime example is diesel engine blocks. Many manufacturers keep a limited spare part inventory, if any at all, on slow moving items, especially in states where inventory tax is imposed.

New Ships

A difficult problem in ship construction is created when provisioning is not invoked. MIL–P–15137C is the provisioning military specification and is not always invoked, both for government-furnished material and contractor-furnished material. Provisioning is the initial step in ensuring that follow-on supply support action will be taken for the ship. As part of the provisioning action, Provisioning Technical Documentation is submitted to the Ship Parts Control Center for new components with recommendation as to range of repair parts to be carried as on-board repair parts. This action leads to an approved allowance of on-board repair parts in both range and depth. Action is then initiated to have Federal Stock Numbers assigned to new repair parts, and to advise all inventory control points of new supply stock requirements to ensure the availability of replenishment repair parts.

Unless a Federal Stock Number with applicable stock is established, requests from the Fleet for repair parts are needlessly complex causing extensive technical research, resulting in a single spot buy. This can only result in lost time for everyone. If the equipment selected is already in the Fleet, then the contractor need only certify identity to an existing Allowance Parts List and, since range and depth of on-board repair parts have already been established and stock is in the system for backup, no time is lost.

Shipbuilders need to pay more attention to provisioning, as will be discussed later in this article. This

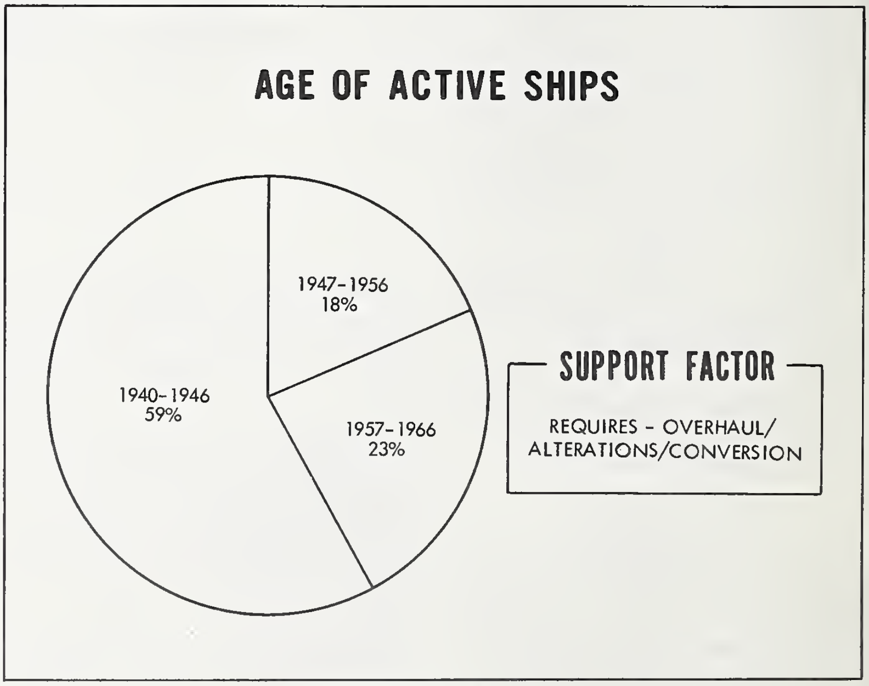

Figure 2.

Selected CIDs/APLs Population

CID No.	Item	1963	1964	1965	1966	1967	Percent Increase (1967/1963)
01	Pumps	5,076	6,609	7,217	7,777	7,889	55
06	Compressors	575	712	783	848	876	52
15	Controllers	11,728	14,558	15,964	17,368	17,846	52
16	Generators	840	1,111	1,177	1,216	1,234	47
17	Motors	11,715	14,619	15,916	16,910	17,425	52
33	Air Conditioning	65	78	128	167	198	200
45	Gages	931	1,262	1,705	1,951	2,114	160
48	Filters	1,216	1,699	1,949	2,145	2,273	87
78	Couplings	624	1,021	1,054	1,103	1,124	79
88	Valves	24,061	35,314	40,611	43,670	46,096	91
91	Laundry Equipment	453	559	593	638	697	54

Figure 3.

requirement is essential if the ship is to be supported during its operation by the supply system for repair parts.

Hardware is worthless if technical documentation does not adequately cover the component/equipment.

As much as 20 percent of the component/equipment is not received until the final months of the construction period, which does not provide sufficient time to accomplish all the actions that will provide repair parts from the supply system on commissioning. Approximately 70 to 75 percent of hull, mechanical and electrical equipment in newly constructed ships is covered by existing Allowance Parts Lists.

New Designs

The influx of new equipment in the hull, mechanical and electrical component/equipment has created problems in repair part support where:

- The "new car" approach is taken by some designers. By this approach designers change a few dimensions of parts that do not increase production costs but result in new repair parts, new Federal Stock Numbers for the same basic equipment. Sometimes this is profitable for the manufacturer and costly for the shipbuilder when new Provisioning Technical Documentation results. The value of the change is sometimes questionable.
- Additional types of the same functional components are introduced into the system by variance in design which results in a multitude of Federal Stock Numbers for the same type of item. As an example of corrective action, smooth bore spare couplings were once stocked for various pumps and motors; now, by stocking rough bore couplings and having the ship turn them to fit, the need for stocking numerous items has been eliminated. In another instance, a new specification, invoking maximum standardization, requires only 13 stock numbers to cover all bimetal thermometers, in lieu of the several hundred numbers previously required. Concentrated effort in standardization of many such items will help alleviate the Fleet's dilemma. Fruitful standardization results can be obtained, by the design and definitive specification route, in fractional horsepower motors, filters, electrical controllers, flexible connections, gages, valves and shipboard laundry equipment.

Standardization

Would you believe standardization, or the lack thereof, in old and new ships?

Before delving into this topic, some pertinent terminology should first be identified.

- **Component Identification Number (CID)**—a nine-digit number for each component/equipment:

01	112	0012
Pump	Manufacturer	Sequential Serial Number

There are 99 groups involved (01-pumps, 02-boilers, 66-engines, 88 valves, etc.)

Descriptive Supplement Number

	Federal Stock Numbers	
	Before	After
• Purifiers (DSN2030)	82	43
• Doors, Hatches & Scuttles (DSN1310)	620	212
• Axial Fans (DSN1720)	1,375	300

Figure 4.

- **Allowance Parts List (APL):** A description of each component's electrical, mechanical and operating characteristics, and a listing of all repair parts applicable to the component using the component identification number.
- **Preliminary Allowance Parts List (P–APL):** An interim Allowance Parts List issued in cases of incomplete characteristics.
- **Coordinated Shipboard Allowance List:**

Part I—Summary of effective Allowance Parts Lists and an index of components or equipage groups.

Part II—Allowance Parts List for each component/equipment installed in the ship.

Part III—Stock Number Sequence Listing of each repair part in Part II that is coded for onboard.

Findings

In June 1965 the Navy Logistic Support Task, under Project Number V, stated in part, "Logistic support would be greatly improved by increased standardization and configuration control of systems and equipments. . . ."

There is an apparent direct tie-in with standardization programs for the Fast Deployment Logistics (FDL) ship and the new Landing Helicopter Assault (LHA) ship. The Naval Ships Systems Command (then Bureau of Ships) recommended to the Secretary of the Navy in September 1965 that "Equipment for new construction should conform to an established Allowance Parts List." Exceptions were:

- Existing Allowance Parts Lists don't meet specifications.
- Prohibitive cost could result.
- Technological advance would be deterred.

The Chief of Naval Material set up the Navy Component/Equipment Standardization organization and issued Task Number 1 in July 1966.

Growth of Allowance Parts Lists

New Allowance Parts Lists reflect equipments being added to the Fleet as follows:

36,000 added between 1963–1964.
16,000 added between 1964–1965.
11,000 added between 1965–1966.
5,800 between October 1966–April 1967.

It will be at least another 12 to 18 months before the impact of standardization will be felt since, although much of the equipment was procured early in the ship's availability, the Allowance Parts Lists are only now being prepared due to phased provisioning action.

The significant point is that from Oct. 1, 1963, to April 1, 1967, basic Allowance Parts Lists have grown from 112,500 to 168,000, about a 50 percent increase.

Component/Equipment Growth

To pinpoint some of the more significant components/equipments insofar as gross numbers are concerned, it can be seen in Figure 3 that, during the past three and one-half years, there has been a marked increase in the number of new components/equipments that has been introduced in Navy hulls, either during new construction, conversion, overhaul, or replacement by ships force.

It must be remembered that any significant deviation from an existing item of equipment, that has an existing Allowance Parts List, causes a new Allowance Parts List to be generated with all the related costs. The question is, what is significant? A prime example is an electric controller, wherein all the parts of the unit by the same manufacturer, are identical in a multi-number of models. The only difference is the thermal element (the heater strip). All the other parts (contacts, springs, relay, physical dimensions of box, etc.) are the same with only one occasional difference—a new model number on the label plate. By grouping similar controllers under one Allowance Parts List and having a select listing for ordering proper heater elements consistent with applications, *i.e.*, horsepower/amperage range, there will be a gross reduction in the number of Allowance Parts Lists, definitely leading towards standardization.

A further review of Figure 3 indicates that the 11 groups of component identification numbers in 1967 represent about 50 percent of the total of 168,000 Allowance Parts Lists, that valves equal 25 percent of the total bank, with motors and controllers being about 10 percent each of the total.

Cause

What caused the growth of Allowance Parts Lists? Technological advances in hull, mechanical and electrical equipment has been limited,

Population of Hull, Mechanical and Electrical Component by Ship Application

Ship Population	No. of APLs	No. of P–APLs	Total No. of APLs	Percent
100 or over	2,901	2	2,903	1.72
50 thru 99	3,185	2	3,187	1.90
10 thru 49	28,687	27	28,714	16.97
5 thru 9	26,631	62	26,693	15.82
4	11,780	150	11,930	7.10
3	16,493	465	16,948	10.04
2	28,259	1,397	29,656	17.57
1	36,520	12,225	48,745	28.88
Total	154,456	14,320	168,776	100.00

Figure 5.

especially in comparison with the field of electronics. There are two reasons that are believed to be the basic causes: competitive bidding; and performance specifications, in lieu of definitive specifications.

Cures

If the cure for new construction is to use only existing Allowance Parts Lists, certain corrective actions need to be taken by the Navy. Operation Purge is this author's approach and is the course of action outlined below, now under way at the Ship Parts Control Center and the Naval Ship Engineering Center's Mechanicsburg Division:

- Cancel all non-component worthy Allowance Parts Lists and duplicates. (Under way.)
- Conduct a manufacturers' review of all applicable Allowance Parts Lists to determine if the item is no longer manufactured or supported; if the item is no longer manufactured, but supported; if duplications of equipment parts are completely interchangeable; and to designate the manufacturer's key identification number. (Copies of Allowance Parts List header [component characteristics] cards were sent to manufacturers of selected groups of component/equipment in April 1967 for their review.)
- Recapitulate reliability of both good and poor performance equipment based on usage data, using total installed population, ship type, and installed service application. (Under way on selected component identification groups—range and depth of Allowance Parts List will be updated as usage dictates.)
- Develop more Descriptive Supplement Numbers (DSN), likened to the old illustrated general stores catalog, for pumps, air compressor valves, etc. (Awaiting approval.) Figure 4 reflects accomplishment on some items where the DSN approach was employed.
- Delete Allowance Parts Lists for common variety valves, two inches and under, that either have no repair parts or only gaskets and packing which could be part of the general stores material or load list. (A project is under way to completely mechanize 60,000 hand-written cards, giving 26 fields of all technical and supply data for all valves. The Naval Ship Engineering Center is sponsoring this project. It will provide necessary engineering data to eliminate duplications, group valves by manufacturer, type size, distance between faces, material, service use, submarine safety, etc.)
- Fully implement the Fleet Logistics Support Improvement Program for shipboard allowance policies (Chief of Naval Operations Instruction 4441.12) which will determine vital/non-vital components; provide military essentiality code, minimum replacement unit, and planned maintenance requirements for each repair part; update the Allowance Parts Lists; and update ships allowance. Maintenance levels are to be assigned to each repair part, indicating the authorized capability needed to install, repair and condemn, which will make the Allowance Parts List more than a supply aid. (Already under way, this operation will take about three years and will result in a complete manual review of all data and Allowance Parts Lists.)
- Delete component identification numbers and Allowance Parts Lists that should be either Allowance Equipage List or General Stores Material. (Under way.)
- A joint meeting was held with the planning officers and supply officers of all Naval Shipyards and two District Supervisors of Shipbuilding to discuss industrial ship repair problems. Each activity subsequently reported its most troublesome Allowance Parts Lists. (Ship Parts Control Center is reviewing the repair parts support for these components and will buy sufficient material in range and depth to support the yards.)
- Review Allowance Parts Lists for the purpose of purging part number items which were, over the years, procured as on-board repair parts, but not bearing Federal Stock Numbers were not procured for system stocks. Accordingly, requisitions received for such items are being filled by spot purchases. (These part numbers are now being reviewed by the Ship Parts

Active Fleet "Onesie" APLs

CID	Name	Quantity	Percent of Total
01	Pumps	1,291	16
02	Boilers	60	18
03	Heat Exchangers	299	18
04	Condensers	195	19
06	Compressors	133	15
08	Distilling Plants	34	13
14	Circuit Breakers	687	17
15	Controllers	3,779	21
16	Generators	202	16
17	Motors	3,563	20
18	Motor Generators	82	15
19	Relays	304	19
21	Switches	1,663	20
32	Refrig. Equipment	443	21
33	Air Conditioning	70	35
34	Starters	26	9
40	Fans	359	21
43	Galley Equipment	366	19
61	Controls	837	16
66	Engines	107	12
78	Couplings	141	12
88	Valves	9,324	20
91	Laundry Equipment	153	22
	Other	24,627	—
	Total	48,745	—

Figure 6.

Control Center for: requirement to be on-board repair parts, existence of Federal Stock Numbers, obtaining required new Federal Stock Numbers, and procurement of system backup stocks.)

Existing Fleet

As a bit of interesting data on the population of hull, mechanical, and electrical components by ship application, Figure 5 shows that, of the total 168,776 Allowance Parts Lists applicable to active fleet ships, 107,279 (or 64 percent) are applicable to four or less hulls.

Twenty-nine percent of the 168,776 different types of equipment are installed in only one hull—"onesies." There may be more than one of the same component installed in the ship but that component, regardless of total number installed, is applicable to that ship only.

Figure 6 indicates the number of significant "onesies" applicable to the active Fleet. Also indicated is the percentage of the "onesie" item in relationship to the total bank of Allowance Parts Lists for the same component identification number group. Controllers, refrigeration equipment, motors, air conditioning equipment, fans, laundry equipment and valve "onesies" Allowance Parts Lists each average better than 20 percent of their respective total number of Allowance Parts Lists.

A review of the listing of single-hull application Allowance Parts Lists on active ships reflects the following average number of "onesies" per indicated ship type:

Destroyer tenders	(AD)	120
Oilers	(AOE)	599
Repair ships	(AR)	182
Submarine tenders	(AS)	395
Attack aircraft carriers	(CVA)	392
Destroyer leaders	(DL)	101
Guided missile destroyers	(DLGN)	613
Nuclear submarines	(SSN)	115
Ballistic missile nuclear submarines	(SSBN)	35

Less than 10 percent of the active Fleet has 50 percent of the "onesies" installed.

Conventional destroyer types, built during World War II, do not present a problem in single-hull application. A comprehensive study, conducted by Submarine Force, Atlantic Fleet, of ballistic missile nuclear submarine logistics, based on a commonality index, developed the various aspects of standardization or lack thereof.

A detailed study, known as Chief of Naval Material Standardization Task Order Number One, is seeking to phase out single-hull application components and equipments and to replace these with high population, reliable, multi-hull application items, based on a life cycle cost effectiveness trade-off of replacement versus repair. The outcome of the test ships now in overhaul will provide useful data in determining what can be done with "onesies." One of the factors being considered is what can be saved by elimination of Federal Stock Numbers. This, however, should not be the only consideration regarding savings from spare parts as there are also manufacturer part-numbered items involved, which are the most costly repair items, that are encountered during major overhauls.

A complete listing of single-hull application of components/equipments for the Fleet was sent by the Ship Parts Control Center to all fleet type commanders and naval shipyards on March 15, 1967, to assist in the Navy's efforts in reducing the number of "single" Allowance Parts Lists whenever consideration of the economics of replacement, during repairs, deems it prudent.

Capt Carl B. Ihli, USN, is assigned as Engineering Assistant to the Commanding Officer of the Ship Parts Control Center, Mechanicsburg, Pa., and has additional duty as Officer in Charge, Naval Ship Engineering Center, Mechanicsburg Division. A major portion of his Navy career has been associated with the maintenance problems of the active and reserve fleets.

Goals

What is the goal for new construction? The answer is, standardization within a class and within a ship's hull.

The continual introduction of supposedly new items requires the costly processing of the Provisioning Documentation and the development of new Allowance Parts Lists at an average administrative cost of $1,000 each. The introduction of new Federal Stock Numbers into the system, at a yearly administrative cost of $100 per item, averages one and one-half new Federal Stock Numbers per new Allowance Parts List.

In addition, the ship has to carry a greater range of spares and, in some cases, this poses a serious space problem, especially if there is a large variety of the same component.

Last, but not least, the training of fleet personnel in the operation, maintenance and repair of the equipment is not as complex when there are few models with which to contend.

How is standardization attained? The answer to this question is to point out to the shipbuilder how he loses money when he buys a variety of equipment for the same application within the hull and, more important, when he buys a new item, with all its related plans, technical manuals, and other documentation, that is not required if an existing Allowance Parts List component is procured that is identical.

In some cases the cost of totally new documentation is more than twice the cost of the new component. With a bank of an estimated 100,000 Allowance Parts Lists that are reliable, high-population items, it would seem very prudent and wise to review these available equipment models to determine suitability to all requirements before introducing a new similar item.

The courses of action that are being taken, some of which have been highlighted in this article, by the engineering and supply members of the Navy team, in understanding and mutually attacking the equipment and spare parts problem, should do much to erase the Fleet's spare part dilemma.

The Defense Market System

Lieutenant Colonel David I. Cleland, USAF
First Lieutenant William R. King, USAF

[Editor's Note: This article is adapted from a book by the authors titled, "Systems Analysis and Project Management" to be published by McGraw-Hill Book Co., in early 1968.]

The Defense Department is the largest single customer of the American industrial complex. Private industry, under government control, develops and produces our major weapon systems. As a result, the magnitude and scale of the defense market,[1] unlike the civilian consumer market, is shaped by long-range planning in the Government.

The Federal budget plays a primary role in determining the direction defense buying will take. Military expenditures are authorized as the result of continued interaction of many demands and requirements, not only of the defense sector of the economy but also of non-defense programs and policies. There are unique risk and uncertainty factors in the market for defense goods; other markets, while not as singular as the defense market, do have characteristics similar to those of the defense market. For example, the market for industrial goods (goods which are used in producing consumer goods, *e.g.*, machine tools) and the construction market have some of the same facets of defense buying and selling. One such aspect is that the purchasing process is consummated with a formal contract, after bids have been submitted and terms have been negotiated.

However, in the defense market, the financial and managerial risks of the contractor center around a small number of ventures. It is this environment in which project management techniques had their genesis and where these techniques have become well accepted.[2]

In the defense market, the actual exchange of the product, *e.g.*, the weapon system, takes place long after the contract for it has been consummated. There is, however, something more complex in the producer-consumer relationship in this market than just a contractual agreement.

A defense producer begins the study development phase of the work well in advance of the Government's request for a contractual bid. Companies in the defense industry are constantly studying and evaluating the military market, hoping to determine the direction military technology will take. Frequently, unsolicited proposals are submitted to the Government. Hence, dependent relationship exists between the Government and the defense industry long before (and after) a defense contract is signed. The involvement between DOD and a defense contractor develops into a bilateral monopoly market and the Government's dependence on a given contractor to fulfill the commitment increases the risk and uncertainty factors.[3]

The salient characteristics of the defense and consumer markets in the United States may be summarized as shown in Figure 1 (page 8).

The consumer market operates on the basis of supply and demand which involves some risks and uncertainties. However, even though a vast proportion of new consumer products become marketing failures,[4] the scope of the risks and uncertainty do not compare with those to be found in the defense industry.[5] The financial outlay required for research, capital equipment, and unique test facilities to develop a weapon system is frequently of such magnitude that a private company could not afford to do it alone. The Government has recognized this and often supports these efforts by providing industrial facilities, advance and progress payments, and assistance in acquiring strategic materials.

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[1] *For our purposes, a market is defined as a place where buyers and sellers exchange a commodity or a service.*

[2] *See Cleland, David I., "The Project Manager—Manager Extraordinary,"* Defense Industry Bulletin, *May 1965.*

[3] *A bilateral monopoly, in economic terms, is a one-buyer-one-seller relationship, whereas the relationship in the consumer goods market is more typically one involving a few sellers (or many sellers) and many buyers. Bilateral monopoly arises when a single seller deals with a single buyer—there is a high degree of interdependency; one cannot survive without the other.*

[4] *For example, it has been estimated that 80-90 percent of newly introduced packaged grocery products are marketing failures. See Hilton, Peter J., "New Product Introduction for Small Business Owners," Small Business Management Series, No. 17, U.S. Government Printing Office, Washington, D.C.*

[5] *Peck and Scherer have defined the uncertainties of the weapons acquisition process as being of two broad classes:*

- *Internal uncertainties relating to unforeseen technical difficulties in developing a specific system.*
- *External uncertainties having to do with technological changes in weaponry, changes in strategic requirements, and shifts in government policy.*

See Peck, Merton J., and Scherer, Frederick M., "The Weapons Acquisition Process: An Economic Analysis," Harvard University, 1962, (Chapter 2).

Consumer Market	Defense Market
Seller provides initiative for producing products. The basis for his decision is an analysis of the potential market, but he has no certain knowledge of the product's salability.	Buyer establishes the requirement for the product after which the producer formally begins development and production.
Production for inventory made necessary by differences in economies of aggregation at producer and retail levels. (These differences in the economies of aggregation simply mean that producers find it economic to manufacture in large quantities while retailers desire small quantities of wider varieties of products.)	Production for immediate use.
Many homogenous products; buyer has a wide range of choice. There is some real or imagined product differentiation.	Relatively few heterogenous products are produced. The buyer has a choice, but the time and cost of bringing the substitute into fruition precludes any real meaning to the idea of substitutability.
Price is a dominant factor in choice because adequate and competing substitutes are often available.	Price is only one of many factors including quality, availability, and technology to support a specific military requirement.
The operation of the market is somewhat impersonal; it is the aggregate of the wants and needs of many buyers and sellers acting independently.	Market system is personal; the buyer's agent becomes deeply involved with the seller's organization. The market place centers around a few buying agencies operating under executive control of DOD.
The producer finances the development-production effort himself.	In the main the buyer finances most of the development and may provide equipment and facilities for the producer to use.
The market is characterized by monopolistic competition.	Market is essentially one-customer. Although different agents are involved, they all function under uniform policies and procedures of DOD.
Prices for the most part are determined by competition in the usual economic sense.	The price is determined by an evaluation of expected and actual costs. Significant competition may occur between a few producers before the final producer is chosen.
Relatively insensitive to domestic and international politics.	Highly sensitive to domestic and international politics and intrigue.
Demand is either relatively constant (*e.g.*, for staples) or tends to be a function of income (*e.g.*, for non-essentials).	Demand is a function of the technology offered by the seller or our nation's estimate of that possessed by the potential enemy. Scientific achievement may be a major requirement.
Requirements for a given model are relatively stable. Model changes affect demand, but the basic utility of the product changes slowly.	International tension can cause requirements to fluctuate rapidly and violently. The product may be obsolete in terms of military technology as soon as the prototype is produced.
Little or no price negotiation is carried on; the product is offered at a price that is met or not, depending on individual consumer motivation. With a wide range of alternatives, the consumer elects an alternate source rather than haggle over prices.	The price is negotiated, in the main, with selected suppliers chosen by the buyer. The defense customer of a large weapon system normally requests proposals from the producers capable of developing and producing one.

Figure 1.

The nature of the uncertainties is also different in the two markets. Even though consumer acceptance is better defined in the defense market, rapid product obsolescence, changes in military demand and Defense Department management philosophies, high technological risk (a continual widening of the state of the art), the vagaries of potential enemy behavior, all contribute to great uncertainty. These risk factors, when combined with changes in managerial and organizational relationships, create an environment substantially different from that found in the consumer goods market.

Perhaps the greatest difference between the consumer market and the defense market is the buyer-seller interdependency and the organizational involvement this entails. Although there are many "agents" representing the Government, these agents operate under standard policies of the Defense Department. The result is a one-buyer-one-seller relationship in a joint venture extending throughout the life cycle of the system or project.

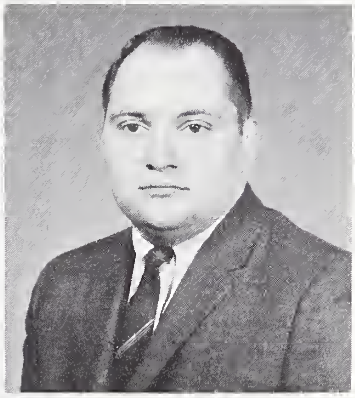
Thus one cannot today look at the defense industry environment and assume transferability of characteristics, policies, and *modus operandi* from the consumer goods industry. There are different forces and motivations in the two markets which serve to differentiate them in ways that are both obvious and subtle.

However, one essential element of the two markets may serve to lessen their differences in the future. That element, formal planning, is exemplified by the management theories and techniques, such as systems analysis, systems project management, planning-programming-budgeting, to name a few, which have been implemented under Secretary of Defense McNamara. The benefits achieved through these innovations have led to the introduction of these modern management approaches in other government departments, as reflected in President Lyndon B. Johnson's directive in 1965, ". . . to immediately begin to introduce a very new and a very revolutionary system of planning and programming and budgeting through the vast Federal Government."[6]

Concurrent with these government resolutions in management have been similar changes in business and industry. The advances in technology and the increased complexity of a "demand creation" economy have outmoded many of the management theories and techniques which were developed for a "demand satisfaction" environment.[7] Recognizing this, industry has applied many of the same modern management ideas. This has resulted in increased emphasis being given to formal planning at all levels of business and industry.[8]

The ideas of formal planning, together with project (systems) management techniques, have demonstrated their utility in a wide variety of organizational environments. In the future these techniques will be extended to such areas as urban renewal programs,[9] transportation systems, and such related endeavors. Increasingly, these programs will have aspects of both business and government activities. Indeed, many of them will be performed on joint bases which involve elements of both the consumer and defense market systems. As these activities become more predominant, a new market system may begin to evolve.

Lieutenant Colonel David I. Cleland, USAF, is Associate Professor of Management and Assistant Head, Department of Systems Management, at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. He holds a masters degree in Business Administration from the University of Pittsburgh and a Ph.D. degree from the University of Ohio.



First Lieutenant William R. King, USAF, is Assistant Professor of Statistics and Operations Research at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. He holds a bachelors degree in Industrial Engineering from Pennsylvania State University and masters and Ph.D. degrees in Operation Research from Case Institute of Technology.

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[6] *As reported in* Time, *Sept. 3, 1965, p. 20.*

[7] *An important element of U.S. business has traditionally been the production and distribution of goods for which there existed a large unsatisfied demand. The affluence of today's U.S. consumer means that most of his basic needs are easily met. The primary marketing function in such a situation is to convince the consumer that he needs a product and then to supply it to him,* i.e., *to "create" a demand in the mind of the consumer which is then fulfilled.*

[8] *See Warren, E.K., "Long Range Planning: The Executive Viewpoint," Prentice-Hall, Inc., 1966.*

[9] *See Herrmann, Cyril C., "Systems Approach to City Planning,"* Harvard Business Review, *September-October, 1966.*

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Managing the Value Engineering Program

George E. Fouch

Industry managers share with DOD managers the responsibility for managing an effective value engineering program in connection with defense contracts. Value engineering staunchly supports the management objective of the Defense Department. It is, moreover, a proven management tool that can be used to avoid the expenditure of a great amount of dollars without any degradation of performance, reliability, or quality requirements.

Soon after the value engineering concept was introduced in the General Electric Co., it was recognized that the concept could significantly contribute to a manager's effectiveness. The vast scope of DOD operations, both in-house and with defense contractors, provides an almost infinite number of opportunities for a rewarding application of value engineering. Because of the hundreds of thousands of individuals, representing many professions and skills, whose work interfaces with value engineering opportunities in our defense programs and projects, the effective management of the DOD Value Engineering Program is no ordinary task. The understanding and cooperation of these many people are needed so that all of our resources are used more efficiently.

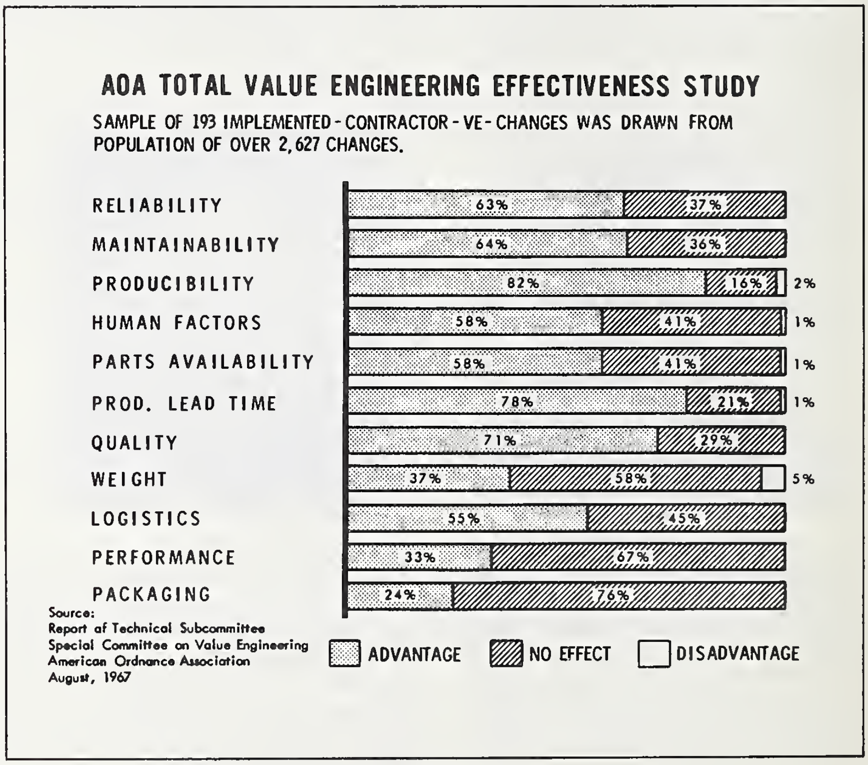
The purpose of this article is to achieve better understanding among our contractor and DOD managers as to how value engineering can contribute to a contractor's competitive position and profit, as well as to the economic achievement of our defense management objectives. Accordingly, this article is written in the hope of realizing a multiplier effect in spreading a better understanding of value engineering throughout the defense industry and DOD. It will cover three aspects of the value engineering program:

- Benefits often realized through value engineering other than reduced costs.
- Value engineering cost reduction achievement in FY 1967.
- Facts relating to contractor-initiated value engineering change proposals.

Total Effectiveness of Value Engineering

In May 1964 a technical subcommittee of the American Ordnance Association (AOA) published a widely circulated report entitled, "Fringe Effects of Value Engineering." Those who are well read on value engineering have probably seen this report. A similar AOA study, broader in scope and entitled, "Total Effectiveness of Value Engineering," has just been completed. The results of this study, like the Fring Effects study of 1964, again show that value engineering not only reduces costs but also frequently improves the product in many other important aspects. The conclusions from both of these studies show that value engineering is a discipline which permits the manager to achieve reduced costs and, at the same time, realize gains in reliability, quality, performance, producibility and maintainability. What clearer confirmation of additional value could one ask?

Figure 1 portrays the results of the first phase of the 1969 AOA value engineering total effectiveness study of some 193 approved value engineering changes that were implemented by defense contractors. It can be seen that in 63 percent of the changes made re-



Source:
Report of Technical Subcommittee
Special Committee on Value Engineering
American Ordnance Association
August, 1967

Figure 1.

liability was increased; maintainability was improved in 64 percent; quality was raised in 71 percent; performance of the item was improved in 33 percent; and weight was reduced in 37 percent of the cases. The effects on the characteristics studied, all generally favorable, are evidence of the effectiveness of sound value engineering application.

The more aggressive technical managers in the Government and industry are aware of these added benefits of sound value engineering actions. Managers in other nations are also catching on. For example, in a technical paper printed in the February 1967 issue of the *Journal of the Royal Aeronautical Society*, J. R. Ewans emphasized the weight savings achieved by value engineering. Fifty-three percent of the value engineering proposals at British Aircraft Corp. had a most pleasing result of a weight reduction, in addition to the cost reduction. The point is that, in recent years, managers in other nations have realized similar profitable experiences from their value engineering efforts.

***VE GOALS FOR FY 67 AND ESTIMATED RESULTANT SAVINGS FROM FY 67 ACTIONS FOR FY's 68 AND 69**

	FY 67		FY 68		FY 69		FY 67-69 TOTAL	
	Goal	Accomp.	Goal	Accomp.	Goal	Accomp.	Goal	Accomp.
ARMY	$102	*63	$30	49	$10	25	$142	137
NAVY	69	119	21	23	7	14	97	156
AIR FORCE	117	130	35	54	12	52	164	236
DSA	12	14	3	9	1	8	16	31
TOTAL	$300	$326	$89	$135	$30	$99	$419	$560

▨ GOAL ☐ ACCOMPLISHED

$ In Millions
* Supplemental savings report forthcoming because of backlog in process of audit validation.

Figure 2.

VECPs APPROVED

	FY 1966	$ Value	FY 1967	$ Value
Army	435	13.4	354	14.0
Navy	304	8.2	255	4.3
Air Force	210	25.3	138	19.1
Defense Supply Agency	33	0.2	55	1.1
DOD TOTAL	982	$47.1	802	$38.5

$—Estimated value in millions savings to the DOD.

Figure 3.

The total effectiveness characteristics of value engineering have been presented much as one might briefly describe the performance characteristics of an airplane. For example, the take-off distance is X thousand feet, the landing distance is X thousand feet, the service ceiling is X thousand feet, etc. These performance characteristics are important but, if the airplane is a bomber, the primary concern is whether the aircraft can deliver the bombs on the target. In value engineering the acid test is whether the concept can, in practice, satisfy the required function at reduced cost. Does it deliver cost reduction results? The answer is an emphatic yes.

Value Engineering Results in FY 1967

Validated value engineering cost reduction results in FY 1967 again exceeded the established FY 1967 goal. It was considered that the FY 1967 goal was a more difficult goal than for prior years because previous years' results were not carried over. The actual accomplishments are shown in Figure 2. These reported savings are those resulting from new actions taken during FY 1967. Those who cooperated are to be congratulated for the contribution made by their organizations to this outstanding achievement. Accomplishment of savings from new actions generated in FY 1967 was $339 million against a goal of $300 million. When adding the estimated cost savings to be realized in FY 1968 and FY 1969, stemming from these new FY 1967 actions, the three-year accomplishment totals $609 million. This sum exceeds the FY 1967 through FY 1969 goal of $419 million by $190 million.

The investment made in terms of our efforts has produced a substantial reward for DOD, but we have only begun to exploit the full value engineering potential.

Contractor Value Engineering Change Proposals

The Officer of the Assistant Secretary of Defense (Installations and Logistics) analyzes savings from approved contractor-initiated value engineering change proposals (VECPs) which lead to a change to the contract, as well as a savings reported in the DOD Cost Reduction Program. Results from these analyses indicate that all that glitters is not gold. Reviewing the contribution to our total value engineering savings, generated by defense contractors through the VECP route, we see in Figure 3 that savings to DOD from VECPs in FY 1967 declined in numbers and dollars compared to FY 1966 results. The total reported VECP savings to the Government in FY 1967 was $38.5 million compared to $47.1 million in FY 1966.

It is necessary to explain the $47.1 million in VECP savings for FY 1966, and a figure of $36 million that was published at the end of FY 1966. The explanation is simply that $36 million was reported as of the cutoff date of the FY 1966 report, but did not include $11 million in savings from FY 1966 value engineering actions that were later submitted in a supplemental report. Savings of $36 million had been published but later an added "dividend" of $11 million was found. The decrease in number of VECPs from 982 in FY 1966 to 802 in FY 1967 can be seen. The facts then boil down to a lesser achievement in 1967 than in 1966.

The Class I value engineering activity of our many contractors is also monitored. Each high-dollar Class I VECP, submitted with total estimated savings of $50,000 or more before sharing, is reviewed quarterly. This review gives a good indication of those contractors who have been motivated to do effective value engineering. It also gives an indication of the contractors who have not yet been motivated to initiate value engineering effort.

To briefly analyze some results of contractor value engineering activity, Figure 4 indicates FY 1967 results from 34 of our major contractors who produce defense systems and hardware. Eight of these contractors, as a result of high-dollar VECPs, reported savings to DOD amounting to $21.3 million. This is about 45 percent of the total estimated savings for FY 1967 from all VECPs. One of these contractors produced savings to DOD of $5 million, another $4.5 million. The contractors' incentive sharing of these top VECP producers ranged from approximately $400,000 to $2 million. Incentive shares to contractors for successful VECPs are

ESTIMATED SAVINGS TO DOD FROM CLASS I VECPs**

SUBMITTED BY EIGHT MAJOR DOD CONTRACTORS FY 1967

Contractor	Savings to the DOD (Millions)
1	$ 5.0
2	4.5
3	3.0
4	2.7
5	2.0
6	1.8
7	1.2
8	1.1
	$21.3*

* 45 percent of total VECP savings to the DOD in FY 67.

** High dollar VECPs with estimated total savings at least $50,000 before sharing.

Source: DOD VECP Reports—FY 67.

Figure 4.

MAJOR CONTRACTORS PRODUCING NO SAVINGS TO THE DOD FROM CLASS I VECPs* IN FY 67

Contractor	VECP Savings to DOD	Contract Awards (Millions)
1A	$0	$ 930.
2A	0	792.
3A	0	506.
4A	0	337.
5A	0	273.
6A	0	233.
7A	0	172.
8A	0	150.
Total	$0	$3,393.

*High dollar VECP is one with estimated savings at least $50,000 before sharing.

Source: DOD VECP Reports—FY 67.

Figure 5.

***HIGH DOLLAR CONTRACTOR VECPS APPROVED BY MILITARY DEPARTMENTS (34 MAJOR DOD CONTRACTORS) FY 1967**

Military Department	No. VECPs Approved	Savings to the DOD (Millions)	Contract Awards (Billions)	Percent of Contract Awards Saved
X	47	$ 3.3	$ 6.0	1/18 of 1%
Y	7	2.5	4.8	1/19 of 1%
Z	30	12.7	2.7	1/2 of 1%
Totals	84	$18.5	$13.5	1/7 of 1%

*A VECP with total estimated savings before sharing of at least $50,000.

Figure 6

awarded only after a greater savings accrues to the Government. On the average, including all types of sharing arrangements, the VECP dollar has been divided 70 cents to DOD and 30 cents to the contractor.

Looking a bit deeper, in Figure 5 it can be seen that in contrast to the best eight contractor VECP performers, the eight poorest performers, with over $3 billion in DOD business, produced exactly zero in high-dollar VECP results last year. How much unnecessary cost was incurred because these eight contrators alone were not motivated to perform in the Class I VECP area? Total FY 1966 contract awards by the Military Departments to the 34 contractors studied amounted to about $13.5 billion.

From another perspective of VECP performance, the Military Departments approved a total of 84 high-dollar VECPs from the contractors studied. Figure 6 shows that resultant savings to the Government from $13.5 billion in contract awards were $18.5 million.

It is necessary, then, that principal DOD managers wholeheartedly emphasize value engineering in their contracts with their contractor counterparts. Extraordinary emphasis may be necessary at the outset to overcome adverse impressions left by months of neglect or lack of understanding of the nature and mutual opportunities presented in the value engineering program. We want to assure the defense contractor that we are sincere in inviting submittal of sound VECPs for thorough consideration, we will give prompt informative decisions, and we are truly willing to authorize incentive payments where earned. We realize that the contractor must be assured of this fair climate for risking his investment in proposal costs for, after all, when his proposal is disapproved, he gets nothing for his investment.

In summary, your attention has been invited to the total effectiveness of value engineering in producing significant collateral benefits in addition to cost savings. This attribute, as borne out by the AOA value engineering study, is one that any prudent manager will keep in mind.

George E. Fouch has been Dep. Asst. Secretary of Defense (Equipment Maintenance and Readiness) in the Office of the Asst. Secretary of Defense (Installations and Logistics) since Dec. 1962. He has had many years of experience in production expediting and aircraft maintenance, both in the Government and in industry.

Information on the validated contribution of the FY 1967 value engineering program savings to DOD has been given and this year's accomplishment is solid evidence that, collectively, contractor and DOD managers are producing increasing value engineering results.

Management of and participation in the DOD value engineering effort is a rewarding and enjoyable experience, and the methodology is a proven one. The results are measured both in dollars and added benefits in the accomplishment of our prime objective, namely, the effective support of our combat forces in the field, and progress is followed through an established DOD quarterly reporting system.

Who has yet held a management job involving a number of people that is always easy to perform with high efficiency. But one thing is certain. If the effort is not made, the genuine satisfaction of joint productive results will never be realized.

Aerospace Center Approved for USAF Academy

Plans to create an Aerospace Education Center at the Air Force Academy have been approved by the Department of the Air Force.

The center is being planned by the Air Force Academy Foundation, founded initially by a group of public spirited Colorado citizens in lieu of an Academy alumni group during the school's early years.

The proposed $8 million Aerospace Education Center will bring together military and civilian groups to study national and international programs in the environments of air and space. The facility will be designed to meet the specific requirements of conferences, symposia, seminars and similar gatherings and will accomodate up to 1,000 persons.

It is anticipated that start of construction may be possible in 1969.

When completed by the Academy Foundation, the center will be turned over to the Air Force for operation under guidance of the Air Force Academy Aerospace Education Association.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

The appointment of **Maj. Gen. Richard P. Klocko**, USAF, as Dir., Defense Communications Agency, with concurrent promotion to the grade of lieutenant general, became effective Nov. 15.

Dr. Eberhardt Rechtin of the Jet Propulsion Laboratory, California Institute of Technology, has been named Dir. of the Advanced Research Projects Agency (ARPA). He succeeds **Dr. Charles M. Herzfeld** who has accepted a position in industry. As Dir. of ARPA, Dr. Rechtin will be responsible for planning, initiating and directing specific research and development programs as assigned by the Dir., Defense Research and Engineering.

DEPARTMENT OF THE ARMY

Brig. Gen. Wilson R. Reed, formerly Dep. Secretary of the General Staff, Department of the Army, has assumed command of the Automatic Data Field Systems Command, Fort Belvoir, Va. He replaces **Brig. Gen. Roger M. Lilly** who has been assigned as Commanding General, 2nd Region, Army Strategic Communications Command, Richards-Gebaur AFB, Mo.

Brig. Gen. Robert B. Terry is the new Commanding General, U. S. Army Strategic Communications Command, Pacific.

New assignments in the Office of the Chief of Research and Development include **Col. Walter E. Rafert**, Asst. Dir. of Developments; **Col. Wilbur H. Vinson Jr.**, Chief, Nike-X and Space Div.; and **Col. John J. Doody**, Chief, Test and Evaluation Branch, Management and Evaluation Div.

Edgewood (Md.) Arsenal has assigned **Dr. Charles A. Reynolds** as its first Technical Dir. In his new position, Dr. Reynolds is responsible for the technical aspects of the research, development, engineering, quality assurance, manufacturing, mobilization planning and procurement program of Edgewood Arsenal.

Recent assignments at the U. S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., are: **Col. Raymond E. Johnson**, Dir., Aviation Materiel Testing; **Col. John P. Wheeler**, Dir., Armor Materiel Testing; **Col. William D. Meara**, Chief, Test Analysis and Operations Office; and **Lt. Col. Robert B. Tully**, Chief, Infantry Materiel Testing Directorate.

DEPARTMENT OF THE NAVY

The President has nominated **VAdm. Bernard A. Clarey**, who has been serving as Dir. of Navy Program Planning, for appointment to the position of Vice Chief of Naval Operations and promotion to the grade of admiral. He relieves **Adm. Horacio Rivero Jr.** who has been named to succeed **Adm. Charles D. Griffin** as Commander in Chief, Allied Forces, Southern Europe.

RAdm. Edwin B. Hooper, formerly Commander, Service Force, Pacific, has been designated Asst. Dep. Chief of Naval Operations (Logistics). His replacement in the Pacific command is **RAdm. Walter V. Combs Jr.**

RAdm. Leo B. McCuddin has been appointed Commandant, Twelfth Na-District. He relieves **RAdm. William H. Groverman** who has been serving as both Commandant of the District and Commander, Western Sea Frontier.

Capt. George R. Shepard, CEC, has relieved retiring **Capt. Thomas E. Barnett**, CEC, as Commanding Officer of the Midwest Div., Naval Facilities Engineering Command, Great Lakes, Ill.

DEPARTMENT OF THE AIR FORCE

The Air Force has announced the following general officer promotions:

To major general:

Brig. Gen. William B. Martensen, Commander, 1st Strategic Aerospace Div., Vandenberg AFB, Calif.; **Brig. Gen. Guy H. Goddard**, Dep. Dir. for Construction, Office of Dep. Chief of Staff, Programs and Resources, Hq., USAF; **Brig. Gen. Joseph R. DeLuca**, Dir. of Supply, Air Force Logistics Command, Wright-Patterson AFB, Ohio; and **Brig. Gen. William G. Moore Jr.**, Dir., Operational Requirements and Development Plans, Office of Dep. Chief of Staff, Research and Development, Hq., USAF.

To brigadier general:

Col. Augustus A. Riemondy, Dir., Materiel Management, Ogden Air Materiel Area, Hill AFB, Utah, who will assume the position of Dir. of Supply and Services, Office of the Dep. Chief of Staff, Systems and Logistics, Hq, USAF, effective Feb. 1; **Col. David S. Chamberlain**, Dep. Chief of Staff, Civil Engineering, Tactical Air Command, Langley AFB, Va.; **Col. Archie S. Mayes**, Dep. Chief of Staff, Civil Engineering, Pacific Air Forces, Hickam AFB, Hawaii; and **Robert A. Duffy**, Dep. for Reentry Systems, Space and Missile Systems Organization, Norton AFB, Calif.

In Air Force Logistics Command headquarters, **Brig. Gen. Robert A. Berman** has been reassigned from duty as Dep. Dir., Maintenance Engineering, to Comptroller. He replaces **Brig. Gen. Frederick E. Morris Jr.** who was named Commander of the new Advanced Logistics Systems Center at Wright-Patterson AFB, Ohio.

Col. Edwin F. Sweeney has been assigned as Dep. Dir. for Technical Services, Office of Space Systems, Office of the Secretary of the Air Force.

New assignments in the Air Force Systems Command include: **Col. Marvin E. Carver**, Chief, Flight Test Div., Research and Development Center, Griffis AFB, N.Y.; **Col. Walter W. Sanders**, Dep. Dir., Communications Satellite Systems Program Office, Space and Missile Systems Organization, El Segundo, Calif.; and **Col. Raymond J. Disher**, Commander, Test Site Office, Patrick AFB, Fla.

Aviation-Electronics Conference To Be Held at Fort Monmouth, N.J.

Scientists and engineers have been invited by the Army Electronics Command, Fort Monmouth, N.J., to submit papers on the subject of aviation-electronics for inclusion on the program of a symposium for industry to be held March 5-7, 1968, at Fort Monmouth, N.J.

The three-day conference will include a briefing on the research and development activities of the Electronics Command and will feature the presentation of selected papers.

Papers, which should be classified no higher than Confidential, will be accepted from or credited to non-profit institutions only.

A selection committee, consisting of Electronics Command personnel, will review and select papers for presentation and publication.

Deadline for submission of papers is Feb. 20.

Information about the conference or about details concerning the submission of papers can be obtained by contacting:

J. F. X. Mannix
Chief, Technical Industrial Liaison Office
Headquarters, Army Electronics Command
Fort Monmouth, N.J. 07703
Phone (201) 535–2240

AVCOM Publishes Revised Purchasing Guide

The U.S. Army Aviation Materiel Command (AVCOM), St. Louis, Mo., has published a newly revised and updated edition of its information brochure, "Doing Business with AVCOM," which is designed for use by prospective contractors.

The pamphlet provides a ready source of information for firms which have not previously held government production contracts and points out the numerous opportunities open to qualified business concerns.

The 27-page booklet can be obtained from the Army Aviation Materiel Command, Mart Building, 12th and Spruce Streets, St. Louis, Mo. 63103.

Seminar Schedule Set for Government Property Administrators

Three-day seminars for instructing government property administrators have been scheduled in each of the Defense Contract Administration Services Regions (DCASRs) of the Defense Supply Agency. The seminars will cover recent changes in the Armed Services Procurement Regulation (ASPR) relative to improved management of government-owned industrial property used for defense contracts.

Although these seminars are being conducted primarily to train government property administrators, contractor personnel are being afforded the opportunity to attend the seminars.

Seminars have already been held in San Francisco, Los Angeles, Boston and New York. Following is the schedule of upcoming seminars:

Jan. 8-10, 1968
DCASR Philadelphia
2800 S. 20th St.
Philadelphia, Pa. 19101

Jan. 22-24, 1968
DCASR Atlanta
3100 Maple Drive NE
Atlanta, Ga. 30305

Feb. 5-7, 1968
DCASR Cleveland
1367 E. Sixth St.
Cleveland, Ohio 44114

Feb. 19-21, 1968
DCASR St. Louis
1136 Washington Ave.
St. Louis, Mo. 63101

March 4-6, 1968
DCASR Dallas
500 S. Ervay St.
Dallas, Tex. 75201

March 18-20, 1968
DCASR Chicago
O'Hare International Airport
P.O. Box 8758
Chicago, Ill. 60666

March 27-29, 1968
DCASR Detroit
1580 E. Grand Blvd.
Detroit, Mich. 48211

The revised regulation provides for separation and clear identification of the responsibilities of contractors and government property administrators. In the future, each contractor will have written into his contract exacting requirements for receiving, accounting for, maintaining and disposing of government-owned equipment or materials for a defense contract. For government property administrators, the regulation outlines an efficient systematic basis for surveying and evaluating a contractor's property control system.

Defense contractors, who want more information on these seminars, may contact the Chief, Industrial Materials Support Division, in the nearest DCASR office. Names and telephone numbers are as follows:

Anthony Welsh
DCASR Philadelphia
Phone: (215) 271-3571

Henry Richter
DCASR Atlanta
Phone: (404) 261-7310, Ext. 466

Robert Goring
DCASR Cleveland
Phone: (216) 522-5394

Raymond Fancher
DCASR St. Louis
Phone: (314) AMhurst 8-6373

Clifford Hamilton
DCASR Dallas
Phone: (214) RIverside 9-2376

Leroy Anderson
DCASR Chicago
Phone: (312) 694-3031, Ext. 2244

Jay Iskow
DCASR Detroit
Phone: (313) 923-0100, Ext. 491

SELECTED DEFENSE DEPARTMENT ECONOMIC INDICATORS

(Dollars in Millions; Manpower in Thousands; Quarters by Calendar Year)

	1966 I	II	III	IV	I 1967	Apr	May	Jun	II	Jul	Aug	Sept	III	Oct
I. Military Prime Contract Awards														
Aircraft	$ 1,945	$ 2,989	$ 2,696	$ 2,262	$ 2,102	$ 432	$ 1,240	$ 1,377	$ 3,049	$ 394	$ 636	$ 1,483	$ 2,513	$1,249
Missile & Space Systems	1,040	987	1,314	861	1,230	300	260	606	1,166	535	521	524	1,580	323
Ships	355	491	876	239	679	72	129	206	407	178	104	135	417	153
Weapons & Ammunition	555	1,486	692	940	818	279	518	972	1,769	92	415	597	1,104	454
Electr. & Communications Eqpt.	918	1,574	666	915	971	480	338	1,030	1,848	169	364	283	816	272
Other Hard Goods	843	1,842	660	1,029	915	298	362	904	1,564	202	355	228	785	252
Soft Goods	709	922	1,078	989	638	171	199	282	652	588	280	188	1,056	175
Construction	207	392	198	150	232	126	160	340	626	56	100	76	232	56
All Other	1,406	1,963	2,356	1,639	1,605	517	507	963	1,987	1,194	568	573	2,335	522
Total (Excl. of work outside U.S.)	7,978	12,646	10,536	9,024	9,190	2,675	3,713	6,680	13,068	3,408	3,343	4,087	10,838	3,456
Total, Seasonally Adjusted	8,703	10,144	10,716	10,149	10,171	2,920	4,121	3,626	10,667	3,610	3,686	3,665	10,961	3,665
Work Outside U. S.	521	1,195	856	672	453	227	228	379	834	314	382	195	891	193
II. Gross Obligations Incurred														
Operations	8,326	9,604	10,426	9,702	10,229	3,664	3,531	4,239	11,435	3,700	3,835	3,689	11,224	
Procurement	4,374	8,539	5,368	5,276	5,113	1,801	2,485	4,663	8,948	1,045	1,894	3,215	6,154	
Other	2,429	3,470	3,453	2,230	2,519	726	1,130	1,653	3,510	1,246	1,062	1,112	3,420	
Total	15,129	21,613	19,247	17,208	17,861	6,191	7,146	10,555	23,893	5,991	6,790	8,016	20,798	
III. Gross Unpaid Obligations Outstanding														
Operations	3,828	3,777	4,792	5,024	4,644	4,761	4,765	4,513	4,513	NA	5,115	5,267	5,267	
Procurement	18,023	22,119	22,736	23,173	22,780	22,613	22,947	25,248	25,248	NA	23,874	24,925	24,925	
Other	5,747	7,392	8,179	7,888	7,626	7,453	7,628	8,270	8,270	NA	8,559	8,722	8,722	
Total	27,598	33,288	35,707	36,085	35,050	34,827	35,340	38,031	38,031	NA	37,548	38,914	38,914	
IV. Net Expenditures														
Operations	7,689	9,076	8,968	9,087	10,002	3,416	3,335	3,980	10,731	2,898	3,722	3,382	10,001	3,641
Procurement	3,651	3,886	4,392	4,264	5,074	1,783	1,850	1,649	5,282	2,037	1,982	2,041	6,060	2,005
Other	2,757	2,647	2,484	3,092	3,179	918	749	334	2,001	1,231	883 (R)	933 (R)	3,047 (R)	789
Total	14,097	15,609	15,844	16,443	18,255	6,117	5,934	5,963	18,014	6,166	6,587 (R)	6,356 (R)	19,108 (R)	6,435
V. DOD Personal Compensation														
Military	3,181	3,249	3,551	3,606	3,624	1,230	1,196	1,220	3,646	1,310	1,260	1,272	3,842	768 (p)
Civilian	1,937	2,015	2,105	2,135	2,170 (R)	700	776	772	2,248	736 (R)	793	742 (p)	2,271 (p)	
Total	5,118	5,264	5,656	5,741	5,794 (R)	1,930	1,972	1,992	5,894	2,046 (R)	2,053	2,014	6,113 (p)	
VI. Outstanding Payments														
Advance Payments	66	79	90	83	92				80				110	
Progress Payments	4,402	4,346	4,750	5,461	5,981				6,765				7,179	
Total	4,468	4,425	4,840	5,544	6,073				6,845				7,289	
VII. Strength (Manpower)														
Military	2,969	3,094	3,229	3,334	3,371	3,371	3,368	3,377	3,377	3,382	3,393	3,412	3,412	3,416 (p)
Civilian	1,088	1,138	1,184	1,230	1,268	1,273	1,274	1,303	1,303	1,311	1,306	1,274	1,274	1,277 (p)

NA—Not available R—Revised
p—Preliminary
NOTE: Open spaces for Indicators other than No. VI indicate information not available at time of publication.
Indicator No. VI information available only on a quarterly basis.

Directorate for Statistical Services
OASD (Comptroller)
28 November 1967

MEETINGS AND SYMPOSIA

JANUARY

Seminar on **Strain Gage Techniques**, Jan. 8–12, University of Miami, Coral Gables, Fla. Co-sponsors: University of Miami and the Society for Experimental Stress Analysis. Contact: Dir., Professional Education, Div. of Continuing Education, P. O. Box 8005, University of Miami, Coral Gables, Fla. 33124.

Fifth Conference on **Symmetry Principles at High Energy**, Jan. 24–26, University of Miami, Coral Gables, Fla. Sponsor: Air Force Office of Aerospace Research. Contact: Capt. D. R. Lehman, Air Force Office of Scientific Research, 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) OXford 4–5581.

Conference on **Methodologies of Pattern Recognition**, Jan. 24–26, University of Hawaii, Honolulu, Hawaii. Sponsor: Air Force Office of Aerospace Research. Contact: Mrs. R. W. Swanson, Air Force Office of Scientific Research (SRI), 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) OXford 4–5407.

International Conference on **System Sciences**, Jan. 29–31, University of Hawaii, Honolulu, Hawaii. Sponsor: Air Force Office of Aerospace Research. Contact: Maj. Paul J. Daily, Air Force Office of Scientific Research (SRMA), 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) OXford 5–5261.

APRIL

Second National Conference on **Space Maintenance and Extra-Vehicular Activities**, April (date undetermined), Las Vegas, Nev. Co-sponsors: Air Force Aero Propulsion Laboratory, LTV, Inc., and National Aeronautics and Space Administration. Contact: Mr. Clodfelter, Air Force Aero Propulsion Laboratory (APFT), Wright-Patterson AFB, Ohio 45433, Phone (513) 257–1110, Ext. 55875.

International Conference on **Light Scattering Spectra in Solids**, April (date undetermined), U. S. Army Research Office-Durham, Durham, N. C. Sponsor: U. S. Army Research Office-Durham. Contact: Dr. Charles Boghosian, Physics Div., U. S. Army Research Office-Durham, Box CM, Duke Station, Durham, N. C. 27706, Phone (919) 286–2285, Ext. 34.

Symposium on the **Structure of Low Medium Mass Nuclei**, April (date undetermined), University of Kansas, Lawrence, Kan. Co-sponsors: Air Force Aerospace Research Laboratories, University of Kansas and North Carolina State University. Contact: Dr. G. I. Harris, Aerospace Research Laboratories (ARP), Wright-Patterson AFB, Ohio 45433. Phone (513) 255–3613.

Photochemistry and Radiation Chemistry Symposium, April (date and location undetermined). Co-sponsors: U. S. Army Natick Laboratories and National Academy of Sciences-National Research Council Advisory Board. Contact: Dr. E. Hayon, Head, Physical Chemistry Laboratory, U. S. Army Natick Laboratories, Natick, Mass. 01760, Phone (617) 653–1000, Ext. 137.

Symposium on the **Topics of Fluids and Plasmas**, April 16–18, Waldorf-Astoria Hotel, New York, N. Y. Sponsor: Air Force Office of Aerospace Research. Contact: Lt. Col. Robert B. Kalisch, Air Force Office of Scientific Research, 1400 Wilson Blvd, Arlington, Va. 22209, Phone (202) OXford 4–5518.

Fifth Symposium on **Remote Sensing of Environment**, April 16–18, University of Michigan, Ann Arbor, Mich. Co-sponsors: Air Force Office of Aerospace Research, Office of Naval Research and the Department of Agriculture. Contact: C. E. Molineux, Air Force Cambridge Research Laboratories (CRJT), L. G. Hanscom Field, Bedford, Mass. 01730, Phone (617) 274–6100, Ext. 3620.

Annual **Frequency Control** Symposium, April 22–24, Shelburne Hotel, Atlantic City, N. J. Sponsor: Electronic Components Laboratory, U. S. Army Electronics Command. Contact: M. F. Timm, Electronics Components Laboratory (AMSEL–KL–ST), U. S. Army Electronics Command, Fort Monmouth, N.J. 07703, Phone (201) 535–2826 or 535–1728.

MAY

Second International Conference on **Vacuum Ultraviolet Radiation Physics—Interaction with Solids**, May 1–3, Gatlinburg, Tenn. Co-sponsors: U. S. Army Research Office-Durham and Office of Naval Research. Contact: Dr. Robert Mace, Dir., Physics Div., U. S. Army Research Office-Durham, Box CM, Duke Station, Durham, N. C. 27706, Phone (919) 286–2285.

Fifth National Colloquium on **Information Retrieval**, May 3–4, University of Pennsylvania, Philadelphia, Pa. Co-sponsors: Moore School of Electrical Engineering, University of Pennsylvania; Institute of Electrical and Electronic Engineering; Special Interest Group on Information Retrieval, American Documentation Institute; Association for Computing Machinery; and Frankford Arsenal. Contact: George Schecter, Chief, Objectives Analysis Office, Frankford Arsenal, Philadelphia, Pa. 19137, Phone (215) JE 5–2900 Ext. 3219.

Fourth Internation Conference on Universal Aspects of **Atmospheric Electricity**, May 12–18, Tokyo, Japan. Co-sponsors: Air Force Cambridge Research Laboratories, Office of Naval Research and the National Science Foundation. Contact: Capt. J. H. Shock, Air Force Cambridge Research Laboratories (CRTE), L. G. Hanscom Field, Bedford, Mass. 01730, Phone (617) 274–6100, Ext. 3636.

Second International Meeting on **Silicon Carbide**, May 14–16, Pennsylvania State University, University Park, Pa. Co-sponsors: Air Force Cambridge Research Laboratories, Pennsylvania State University and Carborundum Co. Contact: C. E. Ryan, Air Force Cambridge Research Laboratories (CRWF), L. G. Hanscom Field, Bedford, Mass. 01730, Phone (617) 274–6100, Ext. 2234.

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January 1968

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Research Reports

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Clearinghouse for Federal and Scientific Information
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Springfield, Va. 22151

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Electrochemical Carbon Dioxide Sensor. Ionics, Inc., for the Air Fodce, May 1967, 55 p. Order No. AD 655 936.

Investigation of an Integrated Carbon Dioxide-Reduction and Water-Electrolysis System. Battelle Memorial Institute for the Air Force, April 1967, 74 p. Order No. AD 655 937.

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Mechanism of Fatigue of Copper at Interfaces. Columbia University for the Air Force, May 1967, 144 p. Order No. AD 656 427.

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FROM THE SPEAKERS ROSTRUM

Address by Lt. Gen. Jack J. Catton, USAF, Dep. Chief of Staff, Programs and Resources, Hq., USAF, to Old Crows Convention (an association of electronic warfare-oriented individuals) Washington, D.C., Sept 27, 1967.

Electronic Warfare in the Air Force

. . . After World War II, there was almost a total lack of interest and activity in electronic warfare (EW). Consequently, most of the Old Crows flew away! The impact of that mass migration on our military capability was little short of disastrous. The trans- and post-Korean efforts to reconstitute an EW capability in the Air Force—as well as in the other Services—were both painful and expensive. Had circumstances in Korea been otherwise, our lack of EW might have proven fatal. I think it important that we do not permit the Crows to fly away again.

I visualize two factors which may serve to prevent this reservoir of irreplaceable talent and experience from dissipating again. First, there is a growing awareness of the extent to which successful application of aerospace power is absolutely dependent upon a comprehensive and viable EW program. Certainly the pendulum of interest has swung from ignorance and apathy to what might be called an acute sense of awareness. The second factor, which I hope will preserve EW talent, is the association of Old Crows itself. Indeed, it may be that your group will become the predominant factor when the current conflict in Southeast Asia draws to its conclusion. It was the lack of a sense of immediacy which permitted our EW skills to dissipate in the first instance. We all know this sense of urgency will diminish as the impetus or armed conflict diminishes; as the military interest—expressed in grants and contracts—declines; as the spotlight swings to other manifestations of public need. When that time comes—as inevitably it will—this association may well be called upon to serve as the rallying point to preserve the scientific and technological base upon which to build when the need again arises.

A strong information and technical base is absolutely essential to a segment of electronics as dynamic as EW. Such a base did not exist when we began our frantic reconstruction for the Korean conflict. Those were trying days. At one time the Air Force could identify less than 25 officers with the required background in EW. Those few people and some warehouses of surplus equipment were about all we had to work with. But time was on our side fortunately—time, and an opponent either unwilling or unable to employ EW to any marked degree.

Later we were able to reconstitute the basic EW capability in the Strategic Air Command (SAC), but it took a lot of time, effort and a great deal of money. Much of it was a do-it-yourself effort, utilizing World War II equipment. It was a monumental effort, but a successful one. That was the era when our national policy was based principally on massive retaliation. Consequently, the funds available for EW within the Air Force were, by and large, reserved for the bombers of SAC. There were a few folks in the fighter aircraft business who stood reproachfully on the sidelines and complained of this imbalance, but they were few in number and their protests were largely unheeded. Additionally, the EW needs of the Tactical Air Command (TAC) were unclear and the command was not too sure of its specific needs.

Thus it came as no particular shock to some of us, when Southeast Asia operations exposed a deficient EW capability in our tactical aircraft. Mr. John Q. Citizen regards the conflict in South Vietnam as a primitive struggle, characterized by rice paddies, bamboo stakes, tunnels, sampans, etc. He has been told about the air war in North Vietnam. He knows about the heavy anti-aircraft fire around Hanoi, and he has certainly read a great deal about the surface-to-air missiles (SAMs) we have encountered. He has been told that our aircraft loss ratios have been decreasing steadily, and he may be vaguely aware that the SAMs are not nearly so effective as the Russians and North Vietnamese might hope. But I doubt that he fully appreciates the reasons for the low effectiveness of those missiles.

Importance of Electronic Warfare in Vietnam

It turns out that not everybody is crawling around the jungle in black pajamas. We are engaged in a contest with an intelligent enemy who possesses extremely sophisticated and complicated electronic equipment, and who knows how to expoit it to the maximum. Security has permitted us to reveal that the low loss rate to SAMs results from more than just skillful flying.

It has been acknowledged that our EW has also been more than a little successful against radar directed anti-aircraft fire. Again security does not permit us to discuss even more dramatic evidence of the nature of this EW battle. But it goes on daily, and it is no secret to you that EW is being employed more extensively today in Southeast Asia than in any previous conflict. It is also no secret to most of you that the tactical aircraft, which are conducting these daily electronic duels, were not properly equipped for this electronic battle when the conflict began.

Tactical fighter-bomber aircraft initially had literally no EW capability. Crash projects were begun once again, under conditions closely approximating the situation we experienced during Korea. We encountered all kinds of problems. Not the least of these was the initial reaction of the pilots when we proposed hanging anything onto the aircraft which could not be consumed in the engine or dropped on the enemy. This is no longer a problem. Further, we discovered that the designers of fighter aircraft had failed to seriously consider EW. There is not one type of tactical aircraft, operating in Southeast Asia today, which was designed originally with sufficient attention to the requirements of EW. In fact, the F–111, soon to be operational, is the first tactical aircraft to incorporate provisions for EW in its basic design.

My point is that we found ourselves unprepared for EW operations at the outset of the conflict. As with World War II and again in Korea, we have experienced the hasty improvisation of hardware, expensive aircraft modifications in terms of both dollars and degraded performance, short-fuze development and production contracts, etc. However, the situation was not entirely identical to that of Korea. For one thing, in the intervening years, we have invested heavily in EW research and development efforts, although much of these were directed toward bomber aircraft.

Problems of the R&D Effort

However, this substantial investment in research and development has not proved as beneficial as one might reasonably expect. There are at least two underlying problems which tend to limit the effectiveness of the research and development effort. I want to discuss them briefly, because it is important that you understand the difficulties which confront us. I think the solutions are as likely to come from the field and industry as they are to develop within the Pentagon. The first problem is the difficulty of converting promising developmental efforts into large-scale production. We share this deficiency with a large portion of the electronics industry. General Latta—another good friend of the Crows—discussed one aspect of this production problem in a recent speech to the Armed Forces Communications-Electronics Association (AFCEA). He suggested that too large a segment of the electronics industry was preoccupied with solving the problems of tomorrow, rather than the problems of today. The theme of the AFCEA convention was "the best is yet to come." While this is indeed a noble theme, some needs are so urgent today that we may be unable to wait for the promise of a better tomorrow. The search for the "best" may well preclude attainment of the "better."

We need, I think, to concentrate on doing today what can be done today. We need, first and foremost, to obtain a basic EW capability in every tactical aircraft which might conceivably be employed in Southeast Asia or in any other crisis management role this country may be forced to confront in the future. Industry can make a major contribution here through renewed emphasis on the production rather than on development.

Let me hasten to add that the difficulty of transition from development to production cannot be laid entirely at the doorstep of industry. This brings me to the second of the two problems. I wish to spend a few moments on this problem because the solution, if there is one to be found, may come from industry, the universities, or the institutes.

Our problem concerns the difficulty in determining, documenting and presenting the effectiveness of EW in the cost-effectiveness equation. We need your assistance here, and we need it badly. The difficulty lies on the effectiveness side of the cost-effectiveness equation.

Lt. Gen. Jack J. Catton, USAF

Electronic Warfare in the Cost-Effectiveness Equation

No one suggests that quantification of the effects of EW on a resourceful and capable opponent will be an easy task. Some very knowledgeable people have stated that it may, in fact, be impossible. Nonetheless, it is becoming increasingly difficult to compete for funds in the Pentagon unless a proposal is based on something more substantive than intuition, hope, or faith. In this regard, I would like to see some type of standard system of factors which could be used to quantify EW results in such a manner that the effectiveness of a given EW system could be compared to that of another. This would be of immense help to our budgeteers and programmers who often make these kinds of decisions in the defense of EW programs, without possessing a thorough technical background. . . .

EW capability is now a major factor in the design of a new weapon system and has a pronounced effect, not only on the cost and the performance of a weapon system but on the total numbers to be bought.

The design considerations for future aircraft are no longer restricted to such factors as range, altitude and speed. A major concern now is penetrability—the ability to get to the target at all. Penetrability, in this era of the sophisticated defense missile and command/control systems, becomes largely a matter of EW.

If EW is to receive appropriate consideration in this time of tightening budgets, with so many competitors for the dollar, our proposals must withstand the rigid scrutiny of cost effectiveness. It follows that we must find a more suitable measure of performance, one that permits wide application and ease of understanding. . . .

This search for a better handle on cost effectiveness of EW is not just a peculiarity of current Office of the Secretary of Defense management, as has been suggested in the press from time to time. We in the Air Force, and I'm confident I speak for the other Services as well, grow increasingly concerned over the potential impact of EW on the design, the size, the cost, and the employment of future weapon systems. We absolutely must obtain some relevant measure of effectiveness if responsible decisions and judgments are to be made. We ask you to help us solve this problem—one which may well be the most significant EW problem today. . . .

In closing I am reminded of the phrase that Sir Winston Churchill used in probably the first public commendation of EW. "The war of wizards," he called it. Here was a man who understood the larger aspects of EW and its ultimate importance. I suspect he might indorse the continuing efforts to make the Old Crows a viable and truly professional society.

It is a sort of Churchillian wisdom that can be applied to EW problems of the past, present and future; for this was a man who could draw meaningfully from the traditions of history as a basis for progress. I think the rich and colorful history of the Crows can also serve you in a meaningful way as you assume your role in the future.

Address by Maj. Gen. Walter E. Lotz Jr., Asst. Chief of Staff for Communications-Electronics, Department of the Army, at the Annual Meeting of the Assn. of the U.S. Army, Washington, D.C., Oct. 10, 1967.

New Trends in Communications

Over a year ago a senior Army general, upon return from a visit to Vietnam, stated that the item of equipment, which has provided the greatest improvement in ground combat, was the radio set, AN/PRC–25. This radio set, with its vehicular counterpart, the AN/VRC–12, and its aircraft version, is providing reliable and effective voice communications at all echelons within the division, and over the extended ranges required by tactical units in the Vietnam environment.

These equipments, although new to the users, have a long history in the materiel side of the house. Their development started over a decade ago. They were mass produced in the early 1960s and were initially issued to units in 1963. Today all U.S. units in Vietnam and Europe have them. Within a few years they will have been issued to all Army regular and reserve force units.

To this family of tactical FM voice radios has been added another member, the lightweight infantry set. It improves significantly radio command and control from the platoon to squad. It, too, has a long history. The Army completed testing of this set a few years ago. Two were shipped to Vietnam for test in 1966. The reaction was most favorable. Last summer the first production models were sent there, and since then the demand for this set has been overwhelming.

An ingenious variation of the tactical FM family has been used to great advantage in Vietnam—the airborne command and control console. It consists of three standard vehicular radios mounted behind the pilot's seat in a helicopter. With this console a commander can maintain contact with his own and superior headquarters, and with any of his subordinate units. From his vantage point in the helicopter, he can reconnoiter the battlefield and control all the elements of the battle, including maneuver, coordination of firepower, and commitment of reserves and support. The airborne command and control console was first devised by the 11th Air Assault Division in the test of the air mobile concept in 1963. It proved so valuable a tool of command and control in the hands of the 1st Cavalry Division that all divisions in Vietnam now have it.

Because commanders have effective and reliable voice radio, they do not normally resort to written orders as in previous combat experience. In Vietnam, divisions issue written field orders as infrequently as every 10 days. Operations are initiated and controlled by voice radio. Thus the full mobility of Army forces can be exploited, and rapid and flexible responsiveness is achieved.

You can now detect a significant trend in tactical communications—the use of voice radio as opposed to written messages as the primary means of command and control within the division. This is possible because the Army has in inventory effective tactical voice radio equipment that is reliable, flexible and secure, when necessary.

There are significant clues to the future to be found in today's adaptation of portable and vehicular FM radio sets to airborne command and control. The next generation of tactical voice radios should consist of one basic set of modules which can be assembled in various combinations to meet all manpack, vehicular and aircraft needs, including integral voice security.

The Army communicator cannot be self-satisfied just because of success in the tactical FM field. We have communications problems in other areas that cannot be merely glossed over. Let me cite one— the use of manual tactical telephone switchboards. Although in Vietnam we are getting the job done with the boards we have, there is a pressing need to do better. Manual, cord-type switchboards are of World War II vintage. They are inherently slow and inefficient in interconnecting voice circuits, and they are costly in manpower. Automatic electronic switches overcome these disadvantages. In addition, automatic switches make possible many service features not available on cord-type boards. Some of these are the elimination of operator interrupt and erroneous disconnection. These manual switching inadequacies cannot be tolerated by commanders and staffs in the fast-moving combat environment of today. It is a drag on the entire communication system. With the help of industry we must, at an early date, make available an interim system which will improve, serve and provide an orderly transition to the digital transmission and computer switches planned in the future.

The Integrated Wideband Communications System

Another new trend is derived from comunications in Vietnam. It is contained in the Integrated Wideband Communications System (IWCS). The IWCS is a system of multichannel radio and submarine cables which provides long distance trunks between centers of military interest throughout Southeast Asia.

The IWCS represents an investment of several hundreds of millions of dollars. It is being engineered, installed, operated and maintained primarily by the U.S. Army Strategic Communications Command. It represents a truly magnificent effort by Army strategic communicators in responding to urgent operational needs. The magnitude and complexity of this system were aptly described by a senior official of the American Telephone and Telegraph Co. He stated that the Army had undertaken to provide in Southeast Asia in a few years what the Bell System had undertaken to provide on a much larger scale in the United States for the past 80 years.

The IWCS, with its extensions, interconnects bases, headquarters, airfields and depots. Its circuits provide high speed data, long distance telephone dialing, radio programs, and message service within Southeast Asia, and interconnects with other Pacific bases and the Continental United States. It is a strategic communications system serving all the Military Services and other agencies. It is fixed in nature and designed to Defense Communications System characteristics and specifications.

On the other hand, the IWCS provides tactical interconnections between widely dispersed low level combat, combat service, and combat support units. In this sense, it is a tactical communications system replacing a major portion of the Army area communications system. Ordinarily, tactical communications doctrine provides for interconnections between Army tactical communications and the theater strategic communications at the rear of the field army. The IWCS has over 75 such interconnections well forward of the senior Army headquarters.

Many serious engineering, equipment and personnel problems are encountered when numerous tactical interconnections are provided to strategic communications. Tactical circuits must be capable of rapid rearrangement, reconnection and re-engineering to be responsive to the changing tactical needs. Strategic communications equipments and procedures were not designed with this flexibility. In addition, there are incompatibilities in the technical standards of strategic communications equipment and tactical communications equipment. The result is that complex interface equipment is required at the interconnect sites. This adds to the cost and complexity of the system, complicates the training of operation and maintenance personnel, and reduces the time response of the system in a highly transient combat environment.

Experience with the IWCS and with similar wideband networks in Europe and elsewhere shows conclusively that we cannot differentiate, operationally and technically, between strategic and tactical communications. There must be only one set of engineering standards, a single system design philosophy, common operating procedures, common personnel and training, and compatible organization structures for all Army communications networks. We must design an integrated communications system with interconnectable networks from the highest level in the command hierarchy to the lowest.

Joint Commonality and Compatibility

The IWCS points up another significant trend. This is the need for compatibility—even commonality—of joint, combined and other agency communications in the combat zone. I need not elaborate on the nature of joint operations in Vietnam. In the past the Army, to a large extent, designed its tactical Army area system primarily to support ground forces. The Air Force has designed its Integrated Tactical Air Control System to serve TACAIR. We no longer can ignore that, when committed in combat, these systems are superimposed upon one another.

In-theater, broadband systems provide circuits to fight, move and support Army divisions, Air Force groups, Navy task forces, Marine divisions and allied units. They provide communications for logistic, construction, medical, administrative and other support elements. They may serve the needs of other U.S. Government agencies and the national needs of the host country.

It is clear that we cannot, within the combat area, build independent communications systems, costing hundreds of millions of dollars, for each Service and function engineered to peculiar needs of each, operated by standard procedures of each. We must have common procedures, compatible technical characteristics and, to the extent possible, interchangeable equipment.

There is nothing new about interconnecting Service systems or using common or joint communications. The new trend discernible is the far greater degree of integration of the former separate communications systems, facilities and personnel of the Military Services into a single system.

The Secretary of Defense just a few months ago directed the establishment of a joint commonality and compatibility program for tactical command, control and communications that is tying together the efforts of the Military Services. Project Mallard, the Army's future tactical area system, which is being undertaken in cooperation with British, Canadian and Australian armies, has recently received active participation by the Air Force, the Navy and the Marine Corps. The joint commonality and compatibility program and Project Mallard are but two of many joint actions and programs that are reshaping the nature of tactical communications in a manner similar to that of the Defense Communications Agency in the strategic area.

I think it essential for all of us to be keenly aware of the implications of this trend. Standardization, compatibility and even single Service communications support are necessary and inevitable. However, response of communications to the needs of the commanders at all levels must be assured.

Finally, the most significant trend in Army communications concerns communicators themselves. It arises as a result of a series of actions directed by the Chief of Staff of the Army after a review of branch structure and officer careers.

The first of the actions I wish to highlight occurred in June 1966 when the Chief of Staff approved the functions of signal officers which were derived from the following rationale: "The Signal Corps is an arm and as such signal officers must be qualified to serve as an integral member of the combined arms team. They must be qualified and proficient in all aspects of combat planning and operations in order to participate effectively and render the necessary communications and electronics capabilities required for command and control, fire, maneuver, intelligence and logistical support."

The second action at the same time was a Chief of Staff decision to designate all Army communications officer positions as Signal Corps assignments. These positions are those staff communications positions in the battalion headquarters of infantry, artillery, armor and other branch units.

The Function of the Army Communicator

Since its founding in the days of the Civil War, the Signal Corps has had the mission of providing communications. However, as the modern era of electronics dawned, this branch accumulated many other missions of importance. These diluted the Signal Corps' efforts in its tactical communications role. Now we see a redirection of orientation of signal officers to their bread and butter mission—communications support of combat.

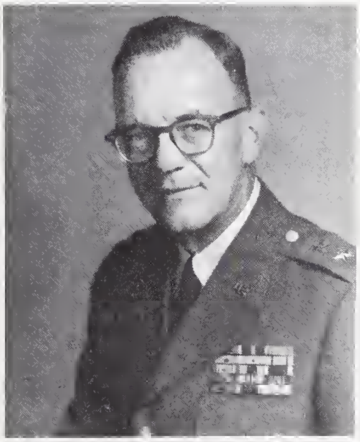
The Korean War was the last occasion when professional communicators, Signal Corps officers, filled communications positions in the basic combat arms units. However, after the war this practice was discontinued. In 1963, with the reorganization of the ROAD Division, the brigade communications officer position was designated a Signal Corps slot. Now the assignment of Signal Corps officers to serve as battalion communications officers place junior signal officers as integral members of the combat team. After all, if a Signal Corps officer is to be primarily oriented toward combat communications, he must be given the opportunity of learning and proving himself to be both a professional soldier and a communicator.

The above actions, when viewed together, clearly outline a pattern—communications personnel have become a part of the combat team. This is evident in all parts of the Army. Several years ago the Army consolidated training of communications officers at Fort Sill. Starting in January 1967, the input to this course has been entirely signal officers who have completed the basic course at the Signal Corps School or who have had equivalent training. The course has been reoriented more heavily toward tactics of basic combat units. The communications officer receives as much training on the combined arms team as does the artillery officer. Highest priority on the assignment of the graduates of this course is to basic combat units in Vietnam.

As members of the combat team in Vietnam, signal units and personnel have an inescapable obligation to get their job done on their own. Many key communications sites must be on isolated mountain tops—many of these in Viet Cong controlled areas. Signal personnel organize and defend their sites and conduct reconnaissance patrols. They are proving themselves as soldiers as well as communicators.

In summary, the new trends in Army communications are:

- More widespread use of voice radio in command and control of combat units.
- The breakdown of established distinctions between strategic and tactical communications.
- The need for universal compatibility of military communications systems.
- A pressing need for combat qualified officers who can technically cope with modern sophisticated communications systems.



Maj. Gen. Walter E. Lotz Jr., USA

Army Aviation Materiel Command Advisory Group Formed

A seven-man Aviation Scientific Advisory Group, consisting of leaders in the fields of aeronautical research, development and education, has been formed to advise Major General John Norton, commander of the Army Aviation Materiel Command (AVCOM), St. Louis, Mo., on scientific and technological matters.

Chairman of the group is Professor Rene H. Miller, Slater Professor of Flight Transportation at the Massachusetts Institute of Technology's Department of Aeronautics and Astronautics.

Members include:

Dr. Kurt H. Hohenemser, Professor of Aerospace Engineering, Washington University, St. Louis, Mo.

Dean Leon Z. Seltzer, Parks College of Aeronautical Technology, St. Louis University.

Dr. William Bollay, visiting Professor of Aeronautics and Astronautics, Stanford University, Palo Alto, Calif.

Dr. Robert G. Loewy, Associate Professor of Mechanical and Aerospace Sciences, University of Rochester, N.Y., and director of the university's Space Science Center.

Fred W. Wolcott, Vice President of Research Analysis Corp., McLean, Va.

Charles H. Zimmerman, Hampton, Va., former Director of Aeronautical Research for the National Aeronautics and Space Administration, and Chief Engineer with the Army Materiel Command before his retirement last July.

The group will be on call to advise General Norton on matters concerning various aspects of AVCOM's operations.

AVCOM, as the commodity command for the Army's global aviation program, conducts research and development, engineering, purchasing, and provides supply and maintenance support for more than 8,000 Army aircraft, mainly helicopters. The command's funding last year amounted to more than $1.5 billion.

Resource Management Depends on Reliable Reports

Charles W. Kullman

The implementation of Cost Information Reports as a reporting requirement in defense contracts has caused increased interest and more involvement of contractor personnel in these reports. In addition to those who have followed the development of the program through the Cost and Economic Information System (CEIS) and Selected Acquisition Information and Management System (SAIMS), more contracting personnel, DOD and defense contractor, are seeking to know the status of the CIR program, the extent of its implementation, and its relationship to the structure of Resource Management Systems.

The Cost Information Reports were formerly a part of the larger Cost and Economic Information System concept. CEIS has been separated into Cost Information Reports (CIR) and Economic Information Systems (EIS). Within DOD, CIR is assigned to the Office of the Assistant Secretary of Defense (Comptroller), while EIS is assigned to the Office of the Assistant Secretary of Defense (Systems Analysis).

The Place of CIR in Resource Management Systems

Resource Management Systems, in broadest terms, means all the systems that aid DOD management in its task of assuring that resources are obtained and used, both effectively and efficiently, in the accomplishment of DOD objectives.[1] The word "resource" in this context means labor, materials and services, measured in dollar terms. Resource Management Systems include all procedures for collecting and processing recurring quantitative information that relates to resources and that is generated for the use of management.[2] This definition excludes all non-resources, *e.g.*, intelligence, tactical doctrine, military justice; and all non-systems, *e.g.*, one-time collection of data, submission of test reports, and exchange of correspondence.

Resource Management Systems include the following as shown in Figure 1:

- Systems for programming and budgeting.
- Systems for management of resources for operating activities.
- Systems for management of inventory and similar assets.
- Systems for management of acquisition, use and disposition of capital assets.

Charles W. Kullman is the Chief, Cost and Economic Analysis Div., Procurement and Production Directorate, Army Aviation Materiel Command (AVCOM), St. Louis, Mo. He also serves as the Chairman of the AVCOM Contract Adjustment Board. Prior to joining AVCOM in 1960, he served as a contract administrator with the Army Ordnance District, St. Louis.

The Acquisition Information and Management System relates to the management of capital assets and is composed of the Selected Acquisitions Information and Management Systems (SAIMS) and Other Capital Acquisitions. While CIR and EIS formerly comprised the forerunner concept of CEIS, the SAIMS program is a broader concept which, in addition, includes the Contract Funds Status Report, plus Performance Management (see Figure 1).

DOD policy[3] regarding the Acquisition Information and Management System is to:

- Focus on the item (or component thereof) being acquired, its quality, its time schedule, and its cost (in terms of both plans and actuals).
- Include special information subsystems applicable to acquisitions of related major capital items.
- Standardize and control to the extent practicable, so as to minimize the data gathering and reporting workload imposed on contractors and in-house activities.
- Structure so as to minimize changes required to accounting systems used by contractors.

The EIS, CIR and the Contract Funds Status Report components of SAIMS have received Bureau of the Budget approval of their reporting formats. Economic information reports, consisting of the DOD and NASA Plantwide Economic Report (Format 1) and DOD and NASA Individual Project Economic Report (Format 2), collect economic impact data from specific contractors semiannually. The external information is used in conjunction with the Five Year Defense Program (FYDP), and other data developed within the Government will be used to forecast employment by plant and communities.

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[1] *Robert N. Anthony, Assistant Secretary of Defense (Comptroller), "Resource Management Systems," address at the DOD Advanced Planning Briefings for Industry, Boston, Mass., March 3, 1966,* Defense Industry Bulletin, *April 1966, pp. 18–21.*

[2] *DOD Directive 7000.1, Aug. 22, 1966.*

[3] *Ibid.*

The Contract Funds Status Report (CFSR), DD Form 1586, was approved by the Bureau of the Budget in December 1966. It will provide the DOD components with information to assist in updating and forecasting contract fund requirements, in planning and decision making on funding changes, and in developing fund requirements and budget estimates in support of approved programs. It will also provide input data to those DOD managers concerned with the need for and flow of funds. These managers will analyze the CFSR with other inputs for the purpose of forecasting funding needs at the DOD/contractor interface, as well as within DOD channels.[4]

The report is normally to be submitted on a calendar quarter-year basis. Coverage would normally be limited to line items funded in the amount of $500,000 or more. Provision has been made in DOD Instruction 7800.7 for reduced levels of detail for small contracts between $100,000 and $500,000, for time and materiel contracts, and for similar effort where the entire CFSR report might not be required. This reduced level of reporting may be extended to contracts larger than $500,000 if the DOD component does not desire the full report. Excluded from coverage by this report are firm fixed-price contracts. In addition, all contracts, whose total value is less than $100,000, and all contracts, expected to be completed in six months or less, will also be excluded from CFSR coverage.

Definitive instructions are still to be issued on the performance management segment of SAIMS, and further instructions will be issued by DOD on other capital acquisitions —other than included under SAIMS.

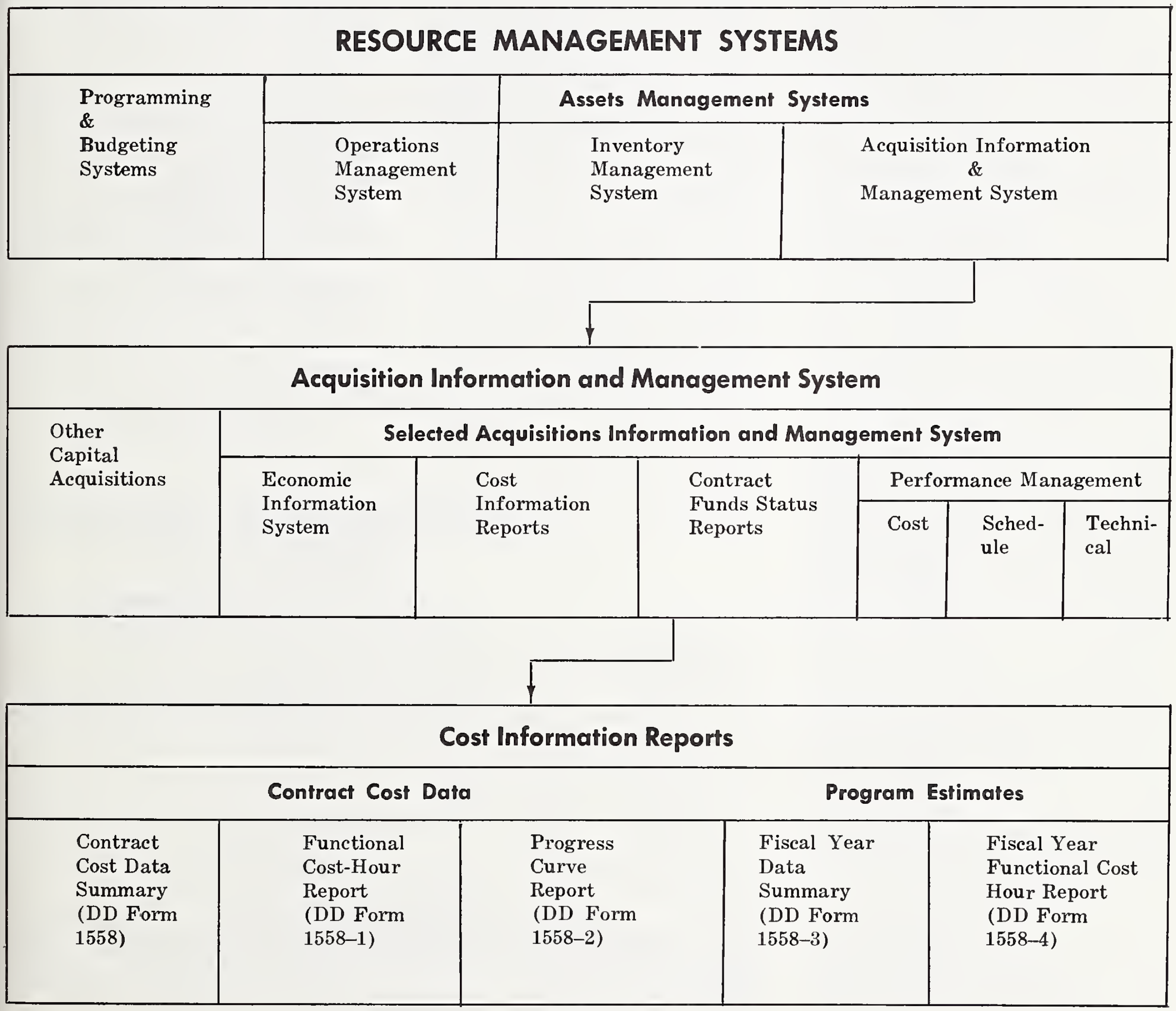
RESOURCE MANAGEMENT SYSTEMS
Programming & Budgeting Systems
Assets Management Systems
Operations Management System
Inventory Management System
Acquisition Information & Management System
Acquisition Information and Management System
Other Capital Acquisitions
Selected Acquisitions Information and Management System
Economic Information System
Cost Information Reports
Contract Funds Status Reports
Performance Management
Cost
Sched-ule
Techni-cal
Cost Information Reports
Contract Cost Data
Program Estimates
Contract Cost Data Summary (DD Form 1558)
Functional Cost-Hour Report (DD Form 1558–1)
Progress Curve Report (DD Form 1558–2)
Fiscal Year Data Summary (DD Form 1558–3)
Fiscal Year Functional Cost Hour Report (DD Form 1558–4)

Figure 1.

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[4] *DOD Instruction 7800.7, Dec. 23, 1966, p. 2.*

CIR Reports

The CIR reports consist of those used for gathering contract cost data and those used for program estimates, as shown in Figure 1. Detailed instructions for preparing the forms are contained in a DOD booklet titled, "Cost Information Reports (CIR) for Aircraft, Missile, and Space Systems," dated April 21, 1966, Budget Bureau No. 22–R260, and will not be covered in this article. The requirement to submit the forms will be a "term" of the contract and be included in the data requirements. The forms will be executed by the contractor, with "contractor" defined to include prime contractor, associate contractor, subcontractor, and in-house DOD equivalents. However, use by the Military Services for reporting by in-house equivalents is optional within each Service, and does not require approval of the Office of the Secretary of Defense which is described later in this article. The purpose of the forms is to assist both industry and Government in estimating and analyzing the costs of weapon or support system development and production. The reporting requirements are not designed to support a detailed system or project management capability.

The data to be collected are important to DOD in carrying out its cost estimating, programming, budgeting and procurement responsibilities. Thus the reports will provide background information useful in performing feasibility and pre-design studies, making choices among competing development of production alternatives, and negotiating systems development and production contracts. The CIR reports will not supplant the current requirements for submission of pre-contractual data where required by the Armed Services Procurement Regulation (ASPR). The long-standing National Inventory Control Point contract price analysis function and the activities of the Defense Contract Audit Agency will not be reduced, with respect to pre-contract or contract modification functions, by the implementation of the CIR forms.

The CIR implementation will extend from the final approval for engineering development through completion of production. The reporting requirements are designed to provide the following:

- Actual costs to date and estimated and actual costs at completion of contracts.
- Estimated costs by fiscal year for support of the Five Year Defense Program and special studies.
- Information in support of DD Form 633, "Department of Defense Contract Pricing Proposal," for new weapon or support system programs, or for the continuation or major modification of current weapon or support system programs. The CIR will not be used to provide information in support of proposals for competitive firm fixed-price procurements as outlined in ASPR 3-807.3.

Control of CIR

CIR reporting is restricted to aircraft, missile and space systems and their related components which are estimated to require cumulative Research, Development, Test and Evaluation (RDT&E) Total Obligational Authority of $25 million, or cumulative production Total Obligational Authority in excess of $100 million. The CIR concept may be extended in the future to include ships, electronic systems, armor, ordnance, or other large systems. The frequency of submission of CIR reports is specified by DOD as shown in Figure 2.

Contractors using the CIR forms will report actual costs to data, plus estimated costs to contract completion. Reporting requirements are established within a framework that provides for cost reporting in a similar functional manner among contractors for items of hardware, software, or services for major classes of items covered by CIR reporting requirements (aircraft, missile, space systems). This framework is the Work Breakdown Structure (WBS) and the items of hardware, software, or services listed functionally by indenture levels are its elements. The WBS elements recommended for CIR coverage are submitted in a CIR Data Plan to the CIR Data Plan Review Committee, in the Office of the Assistant Secretary of Defense (Comptroller). Only the approved requirements for CIR data will be incorporated by the contracting officers in Requests for Proposal, and reflected in resulting contracts.

Deviations from contractual CIR reporting requirements will require contract amendment. Reporting contractors must insure that the proper security classification, within the meaning of the Espionage Act, is assigned to each report. Classification terms, such as Confidential or Secret, may not be used to describe the proprietary nature of data. Company information of a proprietary nature, obtained in the reports, will be protected by DOD.

(Continued on Page 31)

	MINIMUM REPORTING FREQUENCIES REQUIRED BY DOD			
CIR REPORT	**RDT&E FUNDING**		**PROCUREMENT FUNDING**	
DD Form Numbers	Semi-annual	Annual	Semi-annual	Annual
1558	X			X
1558–1	X			X
1558–2	X		X	
1558–3		X		X
1558–4		X		X

It should be noted that all CIR forms except the Progress Curve Report (DD Form 1558–2) may be requested semiannually. The Progress Curve Report may be requested quarterly. The foregoing are maximum reporting frequencies.

Figure 2.

Pollution Threatens Electromagnetic Compatibility

J. Paul Georgi

National defense, with its dependence upon electronics for effective employment of weapons and forces, is faced with a pollution as serious as that threatening our air or water.

This pollution is caused by crowding of the electromagnetic spectrum as more and more equipment is added to the military arsenal.

The Defense Department was the author and champion of the "systems" and "systems analysis" concepts. It is time that this concept be applied in the electromagnetic compatibility area. In this era of nuclear trigger decisions, the philosophy of building black boxes and systems, and then applying fixes to get them to perform their intended functions is passé and hazardous.

To permit the systems approach, analytical tools are being developed at the Department of Defense Electromagnetic Compatibility Analysis Center (ECAC), located across the Severn River from the U.S. Naval Academy in Annapolis, Md.

Established early in 1961 as part of the DOD June 1960 Electromagnetic Compatibility Program, ECAC is currently operating under DOD Directive 5160.57, dated Sept. 23, 1966. ECAC is a joint DOD center, functioning under the direction of the Secretary of the Air Force. Administratively, the center operates as a detachment of the Electronic Systems Division of the Air Force Systems Command.

The mission of ECAC, as defined within the directive, is to provide advice and assistance on electromagnetic compatibility matters to the Secretary of Defense, the Joint Chiefs of Staff, the Military Departments and other DOD components.

Specific responsibilities assigned to ECAC include:

- Establishment and maintenance of data bases necessary for analysis of DOD electromagnetic compatibility problems.
- Development of mathematical models and computer analysis techniques for investigation of inter-Service compatibility problems.
- Rapid access to the ECAC data bases and analysis techniques by other DOD components, and assistance to other DOD components who are developing their own analysis techniques for intra-Service compatibility analysis.
- Analysis of communications and electronic equipment in being, under development, or proposed for development to determine its electromagnetic compatibility with other equipments in present and projected environments, and provision of appropriate recommendations.
- Analysis of frequency allocation and assignment planning to provide appropriate recommendations thereon in support of the Joint Frequency Panel of the Military Communications-Electronics Board.

Since the nature of electromagnetic compatibility is such that potential incompatibility has to be considered at various levels, the clear delineation of ECAC's responsibility for inter-Service level electromagnetic compatibility analysis and the Services' responsibilities for intra-Service compatibility analysis should be noted.

To be responsive to the DOD assigned responsibilities, the ECAC has developed a number of unique facilities and capabilities.

There are approximately 300 people at ECAC, most of them specialists, *i.e.*, mathematicians, electronic engineers, physicists, computer programmers and operators, and data processors, whose sole mission is electromagnetic compatibility. In addition, ECAC has a UNIVAC 1107 computer which is utilized completely for electromagnetic compatibility efforts.

It has, or is in the process of obtaining, a world-wide data base upon which to develop mathematical models and make predictions. The data base consists of:

- An environmental file which contains geographic location and operational information on all military and some civilian communications and electronics equipment.
- A technical characteristics file on the transmitters, receivers and antennas of concern.
- A digitized terrain information file with which propagation losses can be reflected in the system analysis.

In addition, mathematical models, which represent the performance of military operational equipments, have been developed for rapid analysis of interference problems. These mathematical models simulate functions of communications and electronic equipments, propagation phenomena, deployment situations, and other factors that contribute to electromagnetic compatibility problems.

ECAC's overall electromagnetic compatibility data processing and analysis systems have been designed to provide inputs to, or solutions for, 14 basic problem types:

- Listings.
- Site evaluation.
- Frequency assignment for specified geographical locations.
- Site selection (comparison).
- Signal density.
- Susceptibility density.
- Frequency allocation.
- Equipment specifications.
- Equipment comparison.

- Power density.
- Separation criteria.
- Equipment characteristics synthesis.
- Frequency assignment for sterile environments.
- Frequency assignment planning aids.

A problem coming into the center must be defined by the project engineer in terms that the computer can understand. The geographical bounds of the problem determine what environmental data must be extracted from the data base. For example: A receiver operating at a particular ground location should be examined with respect to all transmitters within approximately 200 miles of this location. The same receiver in an aircraft could suffer interference from transmitters within approximately 500 miles. If the same receiver were in a satellite, the potential interfering source might be located within a band around the earth. The problem definition then tells us what portion of the environmental data must be extracted from the data base.

To go through each transmitter receiver pair in the environment is a very tedious task. In general, there are many thousands of equipments in a geographic area. If one were to represent the equations representing the operations of these equipments in sufficient detail to make precise prediction of the interference levels at appropriate receivers of interest, the amount of time required would be excessive. In order to circumvent this problem, a process known as culling is introduced into the model.

This is a process of examining the environment by going through it systematically and rejecting those transmitter receiver combinations which cannot cause interference, refining the process, going through those equipments which are left, and, finally, making relatively precise predictions of interference levels and degradation on the remaining equipments.

There are a number of practical problems which must be considered in predicting interference levels. The first of these problems is the fact that the parameters of the problem are variable, including tuned frequency, modes of operation, antenna adjustments, and other equipment characteristics. Another practical problem arises because of unavailability of data. Included might be terrain elevation data and environment characteristics. The results of these uncertainties is that the final answer will invariably be probabilistic in nature.

The analysis services of ECAC can be considered as a series of steps. At each of these steps, it is possible that an answer to a specific communications-electronics problem can be obtained, but some problems may require going through many steps, each successfully more difficult in analysis. The first step would be the production of an environmental summary listing; in some cases, this may solve certain problems. The second step could be a power density calculation, followed by a cull based on interference-to-noise ratios and a signal-to-noise ratio. In many cases, the results obtained by this process may be insufficient to indicate whether a significant problem is anticipated to determine what the primary cause may be. If this step is not sufficient, further work can be done to produce cull degradation values and again, if this is not sufficient, a more refined prediction of signal-to-interference ratio and degradation values can be made.

In view of the different levels of problem solutions required, *i.e.*, rough cull, refined cull, prediction, etc., ECAC has developed operational automated prediction systems. These systems are systematically used in everyday problem solution. The varying depths of analysis are achieved by using various versions of the prediction system. A brief description of several versions of such a system is given below:

J. Paul Georgi has been the Technical Director of the DOD Electromagnetic Compatibility Center since June 1961. He has served with the Government since 1940 in several positions in the electronic engineering field. Mr. Georgi holds a Master's Degree in Business Administration (Weapon System Manager) from the Air Force Institute of Technology.

- **Version 1.**

All equipment spectral characteristics are synthesized from nominal data providing a conservative cull analysis that can be performed rapidly.

- **Version 2.**

The option is provided to the user in this version to input any desired receiver characteristics whether synthesized, measured, or hypothetical.

- **Version 3.**

The option is provided to input any desired set of emission characteristics for the transmitter.

- **Version 4.**

This version produces the power density at selected environmental locations. It is generally used for siting problems and hazards studies.

- **Version X**

This version provides a degradation analysis capability and is used only after the environment has been culled. Communications degradation, radar scope conditions, and desensitization effects are computed. It is also possible for the user to input any desired transmitter-to-receiver coupling factor in lieu of having the model calculate the propagation path loss and antenna gain. In addition to the basic capability, special analysis systems are sometimes required. ECAC has developed a one-to-one search radar prediction model, a frequency-distance separation model for establishing operational tradeoffs, and numerous other statistical and environmental analysis capabilities. This storehouse of analytical tools provides the flexibility necessary for preventative problem solution, *i.e.*, the potential problem can be studied and corrected before it actually occurs. A problem, by the way, as far as ECAC is concerned, is any analysis effort. Many of our problems are not field problems, but are investigations to determine whether a problem will exist in the field if specific equipment is built or used in a certain manner.

The compatibility analysis experience of ECAC can be applied to a wide variety of inter-Service investigations. The availability of an extensive data base at the center, as well as the development of expertise and specialized analysis techniques, enable ECAC to provide a unique service in this regard. Many U.S. military and government agencies and military-sponsored contractors have already taken advantage of this service.

The following list is typical of the types of evaluations that have been conducted by ECAC:

- Development of a list of potential interference sources and victim receivers.
- Guidance in the selection of locations for satellite communication system ground-station terminals.
- Evaluations and implications of various advanced system design parameters on operational performance in the system's intended environment.
- Development and support of text planning efforts intended to evaluate the effects of electromagnetic compatibility on acquisition and tracking system performance.
- Guidelines for making frequency assignments to various communications and radar mobile/tactical systems and deployments.
- Determinations of power densities in the vicinity of high-power radar systems.
- Analysis of guidance system and missile receiver performance for various tactical missions.
- Evaluation of factors governing operations of collocated high, very high, and ultra-high frequency communications equipments.
- Technical support to frequency management, primarily with regard to the potential effects of incorporating new electronic systems into present environments.
- Determination of expected in-band and out-of-band performance characteristics of planned transmitters and receivers.

The Defense Department has had since June 1960, a comprehensive program to cope with radio interference between electronic equipments and systems. This program recognized that in the final analysis electromagnetic compatibility of electronic equipments and systems would be achieved only through judicial spectrum management, electromagnetic compatibility conscious design, and controlled operational use of communications and electronic equipment and systems. As an integral part of the DOD Electromagnetic Compatibility Program, ECAC has developed data bases, analytical models, computer routines, and interference predictions systems with which to provide support in each of these areas.

Through the proper channels, ECAC services are available to defense contractors. These services are listed in a document titled, "Data and Analytical Services Available from the Electromagnetic Compatibility Analysis Center (ECAC)." This document can be obtained by contacting the Electromagnetic Compatibility Analysis Center, North Severn, Annapolis, Md. 21402.

The Cost Information Reports

(Continued from Page 28)

Progress of Implementation of CIR

As Resource Management Systems continue to develop into a more firm concept, additional guidance has been issued. CIR, as a part of this concept, has benefited from the issuance of directives and instructions including the following:

- DOD Directive 7045.1, Feb. 13, 1964, "DOD Programming System."
- DOD Directive 7041.1, July 7, 1964, "Cost and Economic Information System."
- DOD Instruction 7045.2, Jan. 29, 1965, "DOD Programming System; Procedures for Program Changes."
- DOD Instruction 7041.2, June 13 1966, "Cost Information Reports."
- DOD Directive 7001.2, Aug. 22, 1966, "Resource Management Systems of the Department of Defense."
- DOD Instruction 7800.7, Dec. 23, 1966, "Contract Funds Status Report."

In addition, an ASPR subcommittee is working on a proposed draft of ASPR coverage of CIR, to be followed by inclusion in the ASPR of provisions relating to the Contract Funds Status Report.

As of April 1, 1967, the Assistant Secretary of Defense (Comptroller) received a total of 25 Cost Data Plans for approval of CIR reporting requirements. Sixteen were approved before that date, with the remaining nine being reviewed, or being amended for resubmission. It is contemplated that approximately 11 more Cost Data Plans will be submitted in the near future. This gives some idea of the progress of implementation of CIR into the aircraft missile and space systems.

Recent Developments

DOD is currently planning instructional workshops in CIR for government employees and for contractor personnel on a regional basis. The ASPR subcommittee is exploring the possibilities of obtaining CIR coverage in letter contracts rather than waiting until a definitive contract is written later.

The purpose of CIR, to collect cost and related data on major items of military equipment to assist both industry and Government in estimating and analyzing the cost of weapon system development, is continually coming closer to realization.

Data Systems Center Established by Air Force

An Air Force Date Systems Design Center (AFDSDC) has been established at Bolling AFB, Washington, D.C.

The center will operate as an individual agency, placing under one command the Air Force Headquarters agencies previously engaged in the design of standard automated data systems. The new agency will report directly to the Office of the Air Force Chief of Staff.

AFDSDC mission is threefold: to analyze, design, develop, test, implement and maintain all automated data processing systems assigned to it; to incorporate approved integration and interface requirements in assigned systems and to recommend additional integration and interface; and to develop and maintain nonfunctional software and standards covering programming, programming languages, and documentation for standard automated data systems.

Colonel Vernon R. Turner, previously assigned to Air Force Headquarters, will command the new center.

Fiscal Year 1967
Top 100 Defense Contractors Announced

Top 100 Companies and Their Subsidiary Corporations Listed According to Net Value of Military Prime Contract Awards Fiscal Year 1967 (July 1, 1966–June 30, 1967)

The 100 companies which, together with their subsidiaries, received the largest dollar volume of military prime contracts of $10,000 or more in FY 1967 accounted for 65.5 percent of the U. S. total. This rate was 1.7 percentage points above the 63.8 percent received by the top 100 companies in FY 1966. The increase in the 100-company percentage was due to a sharp upswing in aircraft procurement which rose from $7.5 billion in FY 1966 to $9.7 billion in FY 1967.

Military prime contract awards of $10,000 or more to all U. S. companies for work in the United States and overseas totaled $39,219.4 million, or $5,686.8 million more than in FY 1966. Because of this sizeable increase, it required $46 million in awards for a company to be listed in FY 1967 compared with $40 million in FY 1966. The largest amount going to a company in FY 1967 was $2,124.6 million, whereas the largest in FY 1966 was $1,531.0 million.

Rank	Company	Millions of Dollars
	U. S. Total[a]	$39,219.4
	Total: 100 companies and their subsidiaries[b]	25,693.1
1.	**McDonnell Douglas Corp.**	2,111.6
	Conductron Corp.	5.3
	Hycon Mfg. Co.	5.0
	Tridea Electronics Co.	2.7
	Total	2,124.6
2.	**General Dynamics Corp.**	1,818.7
	Stromberg-Carlson Corp.	12.8
	United Electric Coal Co.	0.4
	Total	1,831.9
3.	**Lockheed Aircraft Corp.**	1,799.8
	Lockheed Shipbuilding & Construction Co.	7.4
	Total	1,807.2
4.	**General Electric Co.**	1,289.8
5.	United Aircraft Corp.	1,097.1
6.	Boeing Co.	911.7
7.	North American Aviation, Inc.	688.8
8.	American Telephone & Telegraph Co.	158.9
	Bell Telephone Co. of Pa.	[c]
	Chesapeake & Potomac Tel. Companies	11.9
	Mountain States Tel. & Tel. Co.	1.7
	New England Tel. & Tel. Co.	0.6
	New Jersey Bell Tel. Co.	0.5
	New York Tel. Co.	0.1
	Northwestern Bell Tel. Co.	0.2
	Ohio Bell Tel. Co.	0.9
	Pacific Northwest Bell Tel. Co.	0.2
	Pacific Tel. & Tel. Co.	0.6
	Southern Bell Tel. & Tel. Co.	2.6
	Southwestern Bell Tel. Co.	1.0
	Western Electric Co.	493.8
	Total	673.0
9.	**General Motors Corp.**	625.0
	Frigidaire Sales Corp.	0.1
	Total	625.1
10.	**Ling-Temco-Vought, Inc.**	91.0
	Continental Electronics Mfg. Co.	4.4
	Continental Electronics Systems, Inc.	[c]
	Kentron Hawaii, Ltd.	12.0
	LTV Aerospace Corp.	310.7
	LTV Electrosystems, Inc.	103.4
	LTV Ling Altec, Inc.	0.9
	Okonite Co. (The)	3.4
	Wilson & Co.	8.9
	Total	534.7
11.	**Textron, Inc.**	16.6
	Accessory Products Corp.	0.1
	Bell Aerospace Corp.	478.2
	Bostitch, Inc.	[c]
	Dalmo Victor Co.	[c]
	Durham Mfg. Co.	[c]
	Maico Electronics	[c]
	Speidel Corp.	0.1
	Textron Electronics, Inc.	1.2
	Textron Industries, Inc.	[c]
	Townsend Co.	0.2
	Total	496.6
12.	**Grumman Aircraft Engineering Corp.**	487.7
13.	**Sperry Rand Corp.**	484.1
14.	**Raymond International Inc.,; Morrison-Knudsen Co., Inc.; Brown & Root, Inc.; & J. A. Jones Construction Co.**	462.5
15.	**Westinghouse Electric Corp.**	442.6
	Deco Electronics, Inc.	3.7
	Thermo King Corp.	6.8
	Total	453.1
16.	**AVCO Corp.**	448.6
17.	**Hughes Aircraft Co.**	419.5
18.	**Ford Motor Co.**	87.4
	Philco-Ford Corp.	316.4
	Total	403.8
19.	**Raytheon Co.**	384.1
	Amana Refrigeration, Inc.	[c]
	D. C. Heath & Co.	[c]
	Edex Corp.	[c]
	Machlett Laboratories, Inc.	18.5
	Micro State Electronics Corp.	0.2
	Raytheon Learning Systems Co.	[c]
	Seismograph Service Corp.	0.3
	Total	403.3
20.	**Honeywell, Inc.**	313.7
21.	**Northrop Corp.**	208.5
	Hallicrafters Co.	17.9
	Northrop Carolina, Inc.	10.9
	Page Communications Engineers, Inc.	69.1
	Total	306.4
22.	**Kaiser Industries Corp.**	5.5
	Kaiser Aerospace & Electronics Corp.	3.5
	Kaiser Jeep Corp.	145.8
	Kaiser Steel Corp.	18.1
	National Steel & Shipbuilding Co.[d]	132.8
	Total	305.7
23.	**Bendix Corp.**	289.3
	Bendix Field Engineering Corp.	4.7
	Bendix-Westinghouse Automotive Air Brake Co.	0.7
	Dage Electric Co., Inc.	[c]
	Fram Corp.	0.7
	Microwave Devices, Inc.	0.1
	Mosaic Fabrications, Inc.	0.5

	P&D Mfg. Co., Inc.	0.1
	Sheffield Corp.	[c]
	Total	296.1
24.	**Martin Marietta Corp.**	274.9
	Bunker-Ramo Corp.	15.3
	Total	290.2
25.	**Ryan Aeronautical Co.**	118.9
	Continental Aviation & Engineering Corp.	26.0
	Continental Motors Corp.	136.5
	Wisconsin Motor Corp.	8.7
	Total	290.1
26.	**General Tire & Rubber Co.**	17.3
	Aerojet Delft Corp.	0.9
	Aerojet General Corp.	224.5
	Batesville Mfg. Co.	25.1
	Fleetwood Corp.	0.1
	Frontier Airlines, Inc.	[c]
	General Tire International Co.	0.7
	Space General Corp.	4.4
	Total	273.1
27.	**Radio Corp. of America**	268.0
	National Broadcasting Co., Inc.	[c]
	RCA Institutes, Inc.	[c]
	RCA Defense Electronics Corp.	0.4
	Total	268.4
28.	**International Telephone & Telegraph Corp.**	149.7
	Barton Instrument Corp.	0.1
	Documat, Inc.	0.1
	Federal Electric Corp.	66.3
	ITT Gilfillan, Inc.	36.1
	ITT Technical Services, Inc.	0.8
	ITT Terryphone Corp.	1.1
	Jennings Radio Mfg. Corp.	0.6
	Puerto Rico Telephone Co.	0.4
	Total	255.2
29.	**Ogden Corp.**	0.0
	Avondale Shipyards, Inc.	227.5
	Eimco Corp.	0.2
	International Terminal Operating Co., Inc.	3.5
	Ogden Technology Labortories, Inc.	0.1
	SMS Instruments, Inc.	1.4
	Tillie Lewis Foods, Inc.	3.3
	Wilson Foods, Inc.	0.7
	Total	236.7
30.	**Standard Oil Co. (New Jersey)**	0.0
	American Cyrogenics, Inc.	0.8
	Esso International, Inc.	144.3
	Esso Research & Engineering Co.	0.7
	Esso Standard Eastern, Inc.	0.1
	Humble Oil & Refining Co.	89.2
	Total	235.1
31.	**Uniroyal, Inc.**	217.3
	Uniroyal International Corp.	[c]
	Total	217.3
32.	**Collins Radio Co.**	201.6
33.	**Hercules, Inc.**	193.5
	Haveg Industries, Inc.	1.7
	Total	195.2
34.	**International Business Machines Corp.**	194.6
	Service Bureau Corp.	0.2
	Science Research Associates	0.1
	Total	194.9
35.	**Newport News Shipbuilding and Dry Dock Co.**	188.5
36.	**Litton Industries, Inc.**	17.7
	Aero Service Corp.	[c]
	Airtron, Inc.	[c]
	Clifton Precision Products Co., Inc.	[c]
	Ingalls Shipbuilding Corp.	12.0
	Kester Solder Co.	[c]
	Kimball Systems, Inc.	[c]
	Litton Precision Products, Inc.	7.5
	Litton Systems, Inc.	142.7
	Monroe Calculating Machine Co.	[c]
	Monroe International, Inc.	0.2
	Profexray, Inc.	[c]
	Total	180.3
37.	**du Pont (E. I.) de Nemours & Co.**	23.3
	Remington Arms, Inc.	156.3
	Total	179.6
38.	**Thiokol Chemical Corp.**	172.7
39.	**F M C Corp.**	161.2
	Ferguson (Harry J.) Co.	0.2
	Gunderson Bros. Engineering Corp.	8.3
	Total	169.7
40.	**Chrysler Corp.**	164.3
	Chrysler International SA	0.4
	Chrysler Outboard Corp.	[c]
	Total	164.7
41.	**Goodyear Tire & Rubber Co.**	60.3
	Goodyear Aerospace Corp.	89.3
	Goodyear International Corp.	0.2
	Kelly-Springfield Tire Co.	0.1
	Motor Wheel Corp.	4.6
	Total	154.5
42.	**Olin Mathieson Chemical Corp.**	154.3
43.	**Standard Oil Co. (California)**	86.4
	Caltex Oil Products Co.[e]	48.3
	Chevron Asphalt Co.	0.1
	Chevron Chemical Co.	0.9
	Chevron Oil Co.	1.9
	Chevron Shipping Co.	0.6
	Community Oil Co., Inc.	0.3
	Pacific Oil Co.	0.1
	Standard Oil Co. (Ky.)	12.0
	Standard Oil Co. of Texas	2.2
	Total	152.8
44.	**Day & Zimmerman, Inc.**	142.2
45.	**General Telephone & Electronics Corp.**	0.0
	Automatic Electric Co.	5.9
	Automatic Electric Sales Corp.	1.0
	General Telephone Co. of the Southwest	0.1
	General Telephone Directory Co.	0.1
	General Telephone & Electronics Laboratories, Inc.	0.1
	Lenkurt Electric Co., Inc.	11.1
	Sylvania Electric Products, Inc.	120.2
	Total	138.5
46.	**Morrison-Knudsen Co.**	2.5
	Ferguson H. K. Co.	0.4
	National Steel & Shipbuilding Co.[d]	132.8
	Total	135.7
47.	**Norris Industries, Inc.**	127.3
	Fyr-Fyter Co.	0.3
	Total	127.6
48.	**General Precision Equipment Corp.**	0.0
	American Meter Controls	[c]
	Controls Co. of America	0.6
	General Precision, Inc.	112.8
	General Precision Decca Systems, Inc.	0.5
	Graflex, Inc.	1.2
	Strong Electric Corp.	1.6
	Tele-Signal Corp.	4.7
	Vapor Corp.	2.8
	Total	124.2
49.	**Texaco Inc.**	24.2
	Caltex Oil Products Co.[e]	48.3
	Jefferson Chemical Co.	0.6
	Texaco Carribean, Inc.	[c]
	Texaco Experiment, Inc.	0.8
	Texaco Export, Inc.	45.5
	Texaco Puerto Rico, Inc.	3.7
	Texaco Trinidad, Inc.	[c]
	White Fuel Co., Inc.	1.1
	Total	124.2
50.	**Sanders Associates, Inc.**	124.0
51.	**T R W, Inc.**	120.5
52.	**Asiatic Petroleum Corp.**	117.2
53.	**Signal Oil & Gas Co.**	7.7
	Garrett Corp.	104.9
	Petroleum Heat & Power Co.	0.1
	Southland Oil Corp.	2.4
	Space Petroleum Corp.	1.7
	Total	116.8

54. Harvey Aluminum, Inc.	116.5
55. Pan American World Airways, Inc.	115.1
56. Mobil Oil Corp.	109.3
57. Eastman Kodak Co.	108.4
Eastman Kodak Stores, Inc.	0.3
Total	108.7
58. Mason & Hanger-Silas Mason Co.	108.4
59. Pacific Architects & Engineers, Inc.	106.9
60. Lear Siegler, Inc.	87.8
American Avitron, Inc.	0.1
Astek Instrument Corp.	0.5
Hokanson (C.G.) Co., Inc.	0.1
L S I Service Corp.	11.6
T. I. C. Engineers, Inc.	0.1
Transport Dynamics, Inc.	0.6
Total	100.8
61. Magnavox Co.	98.5
62. Massachusetts Institute of Technology	94.9
63. American Machine & Foundry Co.	93.2
AMF Beaird, Inc.	c
AMF Tuboscope, Inc.	0.1
Cuno Engineering Corp.	0.5
Voit (W. J.) Rubber Corp.	0.3
Total	94.1
64. Texas Instruments, Inc.	93.4
Metal & Controls, Inc.	0.3
Total	93.7
65. Fairchild Hiller Corp.	93.4
Burns Aero Seat Co.	0.1
Total	93.5
66. Curtiss-Wright Corp.	90.8
67. Teledyne, Inc.	87.8
68. Dillingham Overseas Corp. & H. B. Zachry Co.	87.6
69. Chamberlain Corp.	c
70. Flying Tiger Line, Inc.	73.4
71. International Harvester Co.	72.7
72. Federal Cartridge Corp.	72.4
73. Johns Hopkins University	71.1
74. Aerospace Corp.	70.8
75. Dow Chemical Co.	65.5
Dow Corning Corp.	1.5
Total	67.0
76. Continental Airlines, Inc.	65.7
77. White Motor Corp.	48.1
Hercules Engines, Inc.	15.6
Minneapolis-Moline, Inc.	0.9
Oliver Corp.	0.1
Total	64.7
78. CONDEC Corp.	61.9
Consolidated Controls Corp.	1.1
Total	63.0
79. Western Union Telegraph Co.	62.4
80. Emerson Electric Co.	56.9
Pace, Inc.	0.5
Rantec Corp.	0.1
Supreme Products Corp.	4.7
Total	62.2
81. Firestone Tire & Rubber Co.	61.0
Dayton Tire & Rubber Co.	0.3
Total	61.3
82. Bethlehem Steel Corp.	54.3
Bethlehem Steel Export Corp.	3.7
Calmar Steamship Corp.	2.3
Total	60.3
83. Airlift International, Inc.	59.0
84. Hughes Tool Co.	58.6
85. Cessna Aircraft Co.	52.1
Aircraft Radio Corp.	4.6
Total	56.7
86. Atlantic Research Corp.	56.3
Northeastern Engineering, Inc.	.2
Total	56.5
87. Sverdrup & Parcel, Inc.	0.9
A R O, Inc.	55.6
Total	56.5
88. American Mfg. Co. of Texas	54.9
89. Stevens (J. P.) & Co., Inc.	53.4
90. Vinnell Corp.	53.1
91. Westinghouse Air Brake Co.	14.1
Failing (George E.) Co.	0.3
Le Tourneau-Westinghouse Co.	2.7
Melpar, Inc.	15.4
Wilcos Electric Co., Inc.	19.4
Total	51.9
92. System Development Corp.	50.4
93. Northwest Airlines, Inc.	50.3
94. Gulf Oil Corp.	49.8
Industrial Asphalt, Inc.	0.1
Total	49.9
95. Smith Investment Co.	0.0
Smith, A. O. Corp.	48.5
Total	48.5
96. Motorola, Inc.	42.7
Motorola Communications & Electronics, Inc.	5.0
Motorola Overseas Corp.	0.1
Total	47.8
97. Cities Service Co.	0.0
Cities Service Gas Co.	0.5
Cities Service Oil Co.	39.4
Cities Service Tankers Corp.	7.6
Total	47.5
98. Tumpane Co., Inc.	46.9
99. Union Carbide Corp.	44.5
Englander Co., Inc.	1.0
Konrad Corp.	0.7
Ocean Systems, Inc.	0.6
Total	46.8
100. Maxson Electronics Corp.	45.9
Hopkins Engineering Co.	0.1
Total	46.0

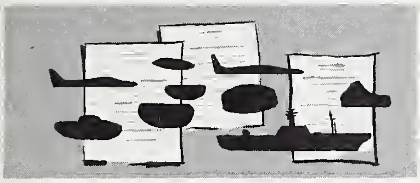
[a] Net value of new procurement actions minus cancellations, terminations and other credit transactions. The data include debit and credit procurement actions of $10,000 or more under military supply, service and construction contracts for work in the United States, plus awards to listed companies and other U. S. companies for work overseas. Procurement actions include definitive contracts, the obligated portions of letter contracts, purchase orders, job orders, task orders, delivery orders, and any other orders against existing contracts. The data do not include that part of indefinite quantity contracts that have not been translated into specific orders on business firms, nor do they include purchase commitments or pending cancellations that have not yet become mutually binding agreements between the Government and the company.

[b] The assignment of subsidiaries to parent companies is based on stock ownership of 50 percent or more by the parent company, as indicated by data published in standard industrial reference sources. The company totals do not include contracts made by other U. S. Government agencies and financed with DOD funds, or contracts awarded in foreign nations through their respective governments. The company names and corporate structures are those in effect as of June 30, 1966. Only those subsidiaries are shown for which procurement actions have been reported.

[c] Less than $50,000.

[d] Stock ownership is equally divided between Kaiser Industries Corp. and Morrison-Knudsen Co.; half of the total military awards is shown under each of the parent companies.

[e] Stock ownership is equally divided between Standard Oil Co. of California and Texaco, Inc.; half of the total of military awards is shown under each of the parent companies.



DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of November 1967:

DEFENSE SUPPLY AGENCY

2—**Bootz Mfg. Co.**, Evansville, Ind. $1,727,056. 6,300 gasoline field range outfits and 2,800 gasoline field range cabinets, with one complete set of tooling for each cabinet and miscellaneous cabinet parts. Defense General Supply Center, Richmond, Va. DSA 400-68-C-2239-TP 512.

—**Otis Elevator Co.**, Cleveland, Ohio. $1,202,826. 226 fork lift trucks. Defense General Supply Center, Richmond, Va. DSA 400-68-C-2262.

—**Michael, Inc.**, Philadelphia, Pa. $1,821,000. 60,000 men's polyester and wool tropical coats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-0890.

—**Bannercraft Clothing.** $1,232,000. 40,000 men's polyester and wool tropical coats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-0891

7—**Raymer Bag Corp.**, New Bedford, Mass. $1,461,645. 7,400,000 polypropylene sand bags. Defense General Supply Center, Richmond, Va. DSA 400-68-C-1658-001.

—**Sun Garden Packing Co.**, Preston, Md. $1,764,615. 336,875 cases of canned tomatoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 130-8-C-115B2.

—**Tri-Valley Growers**, San Francisco, Calif. $1,038,054. 228,992 cases of canned tomatoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 130-8-C-115B3.

8—**American Oil Co.**, Chicago, Ill. $1,226,714. 6,240,000 gallons of gasoline, 638,000 gallons of diesel, and 1,596,000 gallons of fuel oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-68-D-0444.

9—**Morris Bros.**, New York, N.Y. $2,717,072. 1,711,344 white cotton bed sheets. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-0941.

15—**Perl Pillow Co.**, Houston, Tex. $4,739,292. 209,572 mountain sleeping bags. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-0568.

22—**Bonham Mfg. Co.**, Bonham, Tex. $1,448,096. 205,200 men's nylon, cotton sateen field coats. Defense Personnel Support Center, Philadephia, Pa. DSA 100-68-C-0968.

—**Rolane Sportswear**, Ridgely, Tenn. $1,009,500. 150,000 men's nylon, cotton sateen field coats. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-0967.

24—**Addison Shoe Corp.**, Wynne, Ark. $1,944,614. 250,355 pairs of mildew-resistant safety shoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-68-C-1026.

—**General Cable Corp.**, New York, N.Y. $2,270,002. 43,730 reels of telephone cable. Defense Industrial Supply Center, Philadelphia, Pa. DSA 500-68-C-1643.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company—Value—Material or Work to be Performed—Location of Work Performed (if other than company plant)—Contracting agency — Contract Number.

DEPARTMENT OF THE ARMY

1—**AVCO Corp.**, Stratford, Conn. $11,311,300. Turbine engines for the CH-47 Chinook helicopter. Aviation Material Command, St. Louis, Mo. DA-AJ01-67-C2292.

—**Iowa Mfg. Co.**, Cedar Rapids, Iowa. $1,447,560. Diesel engine driven crushing and screening plants. Mobility Equipment Command, St. Louis, Mo. DA-AK01-67-CAO62.

2—**Martin Marietta**, Orlando, Fla. $52,000,000. FY 1968 Pershing ground support equipment. Army Missile Command, Huntsville, Ala. DA-AH01-68-C0532.

—**Boeing Co.**, Morton, Pa. $11,000,000. FY 1969 pre-buy of sets of long lead time items for CH-47C helicopters. Aviation Material Command, St. Louis, Mo. DA-AJ01-69-C0001.

3—**ACF Industries**, St. Louis, Mo. $2,507,400. Metal parts for cluster bomb units. Ammunition Procurement & Supply Agency, Joliet. Ill. DA-AA09-68-C0191.

—**Scovill Mfg. Co.**, Waterbury, Conn. $2,456,622. Metal parts for cluster bomb units. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0190.

—**Batesville Mfg. Co.**, Batesville, Ark. $2,435,517. Metal parts for cluster bomb units. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0189.

—**Chamberlain Mfg. Corp.**, Elmhurst, Ill. $3,796,023. 105mm projectiles. Waterloo, Iowa. Ammunition Procurement & Supply Agency. Joliet, Ill. DA-AA09-67-C0297.

6—**Vatronics, Inc.**, West Patterson, N.J. $1-291,400. Fuzes for aircraft flares. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0195.

—**Hupp Corp.**, Canton, Ohio. $5,148,480. Ten and 20 horsepower, gasoline-operated engines. Mobility Equipment Command, St. Louis, Mo. DA-23-195-AMC-00284.

8—**Brunswick Corp.**, Lincoln, Neb. $1,223,697. Grommets for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. AA-09-68-C0166.

—**Aerojet General**, Downey, Calif. $2,579,200. Metal parts for 2.75-inch rockets. Ammunition Procurement & Supply Agency, Joliet, Ill. AA09-68-C0142.

—**General Motors**, Ypsilanti, Mich. $11,200,428. 20mm guns and gun bodies for use on single wing aircraft. Army Weapons Command, Rock Island, Ill. DA CA41-68-C0014.

—**Thompson-Stearns-Rogers, Inc.**, Denver, Colo. $10,572,011. Conversion and subsequent operation of an existing Government facility at Welden Springs, Mo. Engineer Dist., Kansas City, Mo.

9—**Etowah Mfg. Co.**, Gadsden, Ala. $3,149,525. Metal parts for artillery round boosters. Ammunition Procurement & Supply Agency,. Joliet, Ill. DA-AA09-68-C0205.

—**Delaware Valley Armaments, Inc.**, Mount Laurel, N.J. $4,252,200. Metal parts for artillery round boosters. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0204.

—**Emco Porceilain Enamel Co.**, Port Chester, N.Y. $1,949,000. Small arms ammunition boxes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-67-C-723.

—**Lehigh, Inc.**, Easton, Pa. $2,616,804. Parts for 2.75-inch rocket warheads. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0200.

—**Honeywell, Inc.**, Hopkins, Minn. $2,222,025. Metal parts for nose fuzes for 750-lb. bombs. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill.

—**United Aircraft**, East Hartford, Conn. $6,630,000. Engines for CH-54A aircraft. Aviation Material Command, St. Louis, Mo. DA-AJ01-67-C0875.

—**Sperry Rand Corp.**, St. Paul, Minn. $1,500,000. Classified electronics equipment, Electronics Command, Fort Monmouth, N.J.

13—**Remington Arms Co.**, Bridgeport, Conn. $32,886,583. Manufacture of miscellaneous small arms ammunition. Independence, Mo. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-49-010-AMC-00003 (A).

—**Sperry Rand**, New York, N.Y. $41,241,096. Manufacture, load, assembly and packing of ammunition. Shreveport, La. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00080.

—**Olin Mathieson Chemical Corp.**, East Alton, Ill. $3,416,922. Propellants and related raw materials. Baraboo. Wis. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00106.

—**Standard Products Co.**, Cleveland, Ohio. $3,571,285. Track assemblies for M114 vehicles. Port Clinton, Ohio. Tank Automotive Command, Warren, Mich. DA-AE07-68-C0993.

—**Norris Industries**, Los Angeles, Calif. $1,119,984. Maintenance and repair of facilities in support of 60/80mm projectile metal parts and 105mm cartridge cases. Riverside, Calif. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00998.

15—**Brad's Machining Products**, East Gadsden, Ala. $4,365,000. Metal parts for artillery fuze boosters. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0209.

—**Ingraham Co.**, Bristol, Conn. $1,980,633. Metals part for artillery fuze boosters. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0213.

—**General Time Corp.**, Skokie, Ill. $1,503,590. Bomb fuzes. Frankford Arsenal, Philadelphia, Pa. DA-AA25-67-C0690.

16—**Raytheon Co.**, Bedford, Mass. $8,266,596. Advanced development of SAM-D missiles. Army Missile Command, Huntsville, Ala. DA-AH01-67-C1995.

—**Booz-Allen Applied Research**, Chicago, Ill. $1,765,721. Scientific and technical effort to support continuing studies, evaluation and analyses of military doctrine for the Army Combat Development Command Institute of combined arms and support at Fort Leavenworth, Kan. Northwest Procurement Agency, Oakland, Calif. DA-AG05-67-C0437.

17—**AVCO Corp.**, Stratford, Conn. $25,984,582. UH-1 and OV-1 aircraft engines. Aviation Material Command, St. Louis, Mo. DA-AJ01-68-C0954.

—**Beech Aircraft**, Wichita, Kan. $2,070,050. Bomb dispensers. Salina, Kan. Procurement Detachment, Chicago, Ill. DA-AA09-68-C0009.

—**McDonnell Co.**, St. Louis, Mo. $1,275,000. Development of a trainer set for the medium anti-tank assault weapon system. Titusville, Fla. Army Missile Command, Huntsville, Ala. DA-AH01-67-C0104.

—**Model Screw Products, Inc.**, Hazelwood, Mo. $1,212,750. 4.2-inch cartridge containers. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0021.

20—**American Fabricated Products, Inc.**, Indianapolis, Ind. $1,001,278. Cartridge containers for obturating assemblies for 4.2-inch cartridges. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0022.

—**Harvey Aluminum Sales**, Torrance, Calif. $34,784,577. Loading, assembling and packing of ammunition. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00520.

21—**Chamberlain Mfg. Co.**, Waterloo, Iowa. $1,922,215. Metal parts for 2.75-inch rockets. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-67-C0363.

—**Sylvania Electric Products,** Mountain View, Calif. $4,592,728. Classified work. Santa Cruz, Calif. Mobility Equipment Command, Research and Development Center, Fort Belvoir, Va. DA-AK02-68-C0210.

24—**Amron Corp.,** Waukesha, Wis. $2,588,070. Cartridge cases. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-C0233.

27—**General Time Corp.,** Stamford, Conn. $2,415,000. Metal parts for M125A1 detonator boosters. Gadsden, Ala. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0054.

—**Chamberlain Mfg. Corp.,** Elmhurst, Ill. $2,000,000. Modernization activities at the Army Ammunition Plant, Scranton, Pa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-36-034-AMC-00163.

—**Eastern Tool & Mfg. Co.,** Belleville, N.J. $1,536,493. Metal parts for 66mm rocket warheads. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0226.

—**J.H.W., Inc.,** Dover, Del. $2,277,432. Construction of an elementary school. Okinawa. Engineer Dist., Okinawa. DA-CA79-68-C0034.

—**Watkins Johnson Co.,** Palo Alto, Calif. $1,678,206. Microwave system receivers for technical support of defense programs. White Sands, N.M. White Sands Missile Range, N.M. DA-AD07-68-C0019.

—**Hughes Aircraft,** Culver City, Calif. $1,476,500. Feasibility demonstration project for the Tow/Cheyenne missile system. Army Missile Command, Huntsville, Ala. DA-AH01-67-C2487.

—**Brunswick Corp.,** Sugar Grove, Va. $1,181,860. 30mm cartridge launchers. Army Arsenal, Edgewood, Md. DA-18-035-AMC-00962.

28—**Atlas Chemical Corp.,** Wilmington, Del. $14,081,983. Production of TNT and maintenance activities at the Army Ammunition Plant, Chattanooga, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-531.

—**General Time Corp.,** Stamford, Conn. $10.-553,662. Fuzes. Peru, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0223.

—**Farmers Chemical Assn.,** Tyner, Tenn. $1,349,402. Support services for the manufacture of explosives. Chattanooga, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00300.

—**Ryan Stevedoring Co.,** Mobile, Ala. $5,153,000. Stevedoring services at Brookley AFB, Ala., for period of Jan. 1, 1968 through Dec. 31, 1969. Headquarters, Eastern Area, Military Traffic Management and Terminal Service, Brooklyn, N.Y. DA-HC21-68-D0044.

—**Equitable-Higgins Shipyards,** New Orleans, La. $1,970,081. Repair and alteration of a barge. Engineer Dist., Memphis, Tenn.

—**Honeywell, Inc.,** Tampa, Fla. $1,801,735. Various multiplexers and spare parts. Electronics Command, Philadelphia, Pa. DA-AB05-68-C0613.

29—**I.D. Precision Components Corp.,** Jamaica, N.Y. $2,856,250. Metal parts for boosters. Gadsden, Ala. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C0237.

—**Honeywell, Inc.,** Framingham, Mass. $1,500,000. Classified electronics equipment. Electronics Command, Fort Monmouth, N.J.

30—**Eastman Kodak,** Kingsport, Tenn. $54,412,050. Explosives. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-W-11-173-AMC-35(a).

—**Uniroyal, Inc.,** New York, N.Y. $12,480,340. Various explosive and operations and maintenance activities at the Army Ammunition Plant, Joliet, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00062.

—**General Instrument Corp.,** Chicopee, Mass. $4,491,382. Metal parts for 750-lb. bomb nose fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0246.

—**General Electric Co.,** Burlington, Vt. $6,020,654. Armament pods, 7.62mm automatic guns and ancillary equipment. Army Weapons Command, Rock Island, Ill. DA-AF03-68-C-0019.

—**Raytheon Co.,** Lexington, Mass. $2,690,527. Advance production engineering for the improved Hawk missile system. Andover and Bedford, Mass. Army Missile Command, Huntsville, Ala. DA-AH01-67-C0A019.

—**Martin Marietta,** Orlando, Fla. $2,389,258. Canisters for the aerial mine system. Procurement Detachment, Chicago, Ill. DA-AA09-68-C0028.

—**American Machine & Foundry Co.,** York, Pa. $2,267,352. Metal parts for 4.2-inch mortar projectiles. Procurement Detachment, Chicago, Ill. DA-AA09-67-C0336.

—**Norris Industries,** Los Angeles, Calif. $2,199,274. 81mm projectiles. Vernon, Calif. Northwest Procurement Agency, Oakland, Calif. DA-AG07-68-C-0415.

—**SCM Corp.,** Deerfield, Ill. $1,830,585. Teletypewriter reperforator-transmitters. Electronics Command, Philadelphia, Pa. DA-AB05-68-C0608.

—**Uniroyal,** Mishawaka, Ind. $1,190,400. Collapsible 10,000-gallon-tank assemblies for petroleum. Warsaw, Ind. Mobility Equipment Command, St. Louis, Mo. DA-AK01-67-C-E002.

—**Canadian Commercial Corp.,** Ottawa, Ontario, Canada. $1,093,072. Telescopes and components. DA-AA25-68-C0311. $1.027,-871. 30 caliber ball cartridge propellant. Frankford Arsenal, Philadelphia, Pa. DA-AA25-68-C0310.

DEPARTMENT OF THE NAVY

1—**Kaiser Aluminum & Chemical Sales,** Halethorpe, Md. $4,005,296. AM-2 aluminum landing mats for use on airfields. Naval Air Engineering Center, Philadelphia, Pa. NOO-156-68C-0439.

2—**Teledyne Systems Co.,** Hawthorne, Calif. $7,715,200. Self-contained navigation systems. Naval Air Systems Command. NOOO 19-67-C-189.

—**Alsco, Inc.,** St. Louis, Mo. $2,653,227. Rocket launchers. Naval Air Systems Command. NOOO19-67-C-0621.

—**Sunstrand Corp.,** Rockford, Ill. $2,479,326. Constant speed drives and frequency control boxes for the FY 1968 F-4 aircraft program. NOOO19-68-C-0083. Constant drives and related equipment for A-7 aircraft. Naval Air Systems Command. NOOO19-68--C-0088.

—**Mine Safety Appliances Co.,** Pittsburgh, Pa. $1,759,000. Oxygen-breathing apparatus and oxygen canisters for shipboard firefighting and damage control. Evans City, Pa. Navy Ships Parts Control Center, Mechanicsburg, Pa. NOO-104-68C-1442.

—**Lundy Electronics & Systems,** Glenhead, N.Y. $1,500,030. Countermeasure chaff. Pompano Beach, Fla. Navy Ships Parts Control Center, Mechanicsburg, Pa. NOO-104-68C-0439.

3—**North American Rockwell Corp.,** Columbus, Ohio. $39,756,982. RA-5C weapons systems. Naval Air Systems Command. NOOO19-68-C-0190.

—**McDonnell Douglas Corp.,** St. Louis, Mo. $33,300,000. Long lead time authorization for F-4E, RF-4C, and F-4D aircraft. Naval Air Systems Command. NOOO 19-67-0171.

—**Hartmann-Huyck Systems Co.,** Huntington Station, N.Y. $1,715,000. Airborne navigational computer display systems. Naval Air Systems Command. NOOO19-67-C-0503.

—**Magnavox Co.,** Fort Wayne, Ind. $1,602,168. Airborne detection transmitting sets and associated equipment. Naval Air Systems Command. NOOO 19-67-C-0678.

—**Vocaline Co. of America,** Old Saybrook, Conn. $1,322,000. Sonobuoy, bathythermograph transmitter set and underwater sound signal testing. South Bristol, Maine. Naval Air Systems Command. NOOO19-68-C-0124.

—**General Electric,** Washington, D.C. $1,965,200. Turbine generator sets with voltage regulators and exciters. Fitchburg, Mass. Naval Air Systems Command. NOOO24-68-C-5168.

—**Scope, Inc.,** Restor, Va. $2,600,000. Electronics systems equipment with associated repair parts and technical data. Naval Air Systems Command. NOOO24-68-C-1079.

6—**Southeastern Electric Contracting Co.,** Virginia Beach, Va. $1,429,600. Installation of utilities at the Naval Shipyard, Norfolk, Va. Naval Facilities Engineering Command. Nby-67143.

7—**Westinghouse Electric,** Baltimore, Md. $1,590,00. Design, development and manufacture of one X-Band Radar Impact Scoring System. Naval Ship Systems Command. NOOO24-68-C-1070.

8—**Texas Instruments,** Dallas, Tex. $1,381,000. Equipment used with AN/APQ-116 radar system on A-7A aircraft. Navy Aviation Supply Office, Philadelphia, Pa.

9—**Hughes Aircraft,** Canoga Park, Calif. $15,950,697. Walleye guided missiles for the Navy and Air Force. Naval Air Systems Command. NOOO19-68-C-0126.

—**Grumman Aircraft Engineering Corp.,** Bethpage, N.Y. $11,147,000. Increase in limitation of authorization for EA-6B aircraft. Naval Air Systems Command. NOOO19-67-C-0078.

—**North American Aviation,** Columbus, Ohio. $5,000,000. T-2B aircraft. Naval Air Systems Command. NOw(A)-66-0081.

—**Raytheon Co.,** Bedford, Mass. $3,826,353. Rocket motors. Naval Air Systems Command. NOOO19-67-C-0019.

—**M.I.T.,** Cambridge, Mass. $1,290,000. Fabrication of control equipment spares and computer checkout software for support van for the Navy's Deep Submergence Rescue Vehicle.

—**Norfolk Shipyard and Drydock Corp.,** Norfolk, Va. $1,170,951. Overhaul of oiler USS Aucilla (AO-56). Superviser of Shipbuilding, Fifth Naval Dist., Portsmouth, Va. N62678-68-R79.

13—**Owens Corning Fiberglass Corp.,** Washington, D.C. $1,165,000. Countermeasure chaff. Ashton, R.I. Navy Ships Parts Control Center, Mechanicsburg, Pa. NOO104-68-C-0900.

14—**Alabama Dry Dock & Shipbuilding Co.,** Mobile, Ala. $41,053,900. Construction of two submarine rescue vessels and one exhibiton model of the ship type. Naval Ship Systems Command. NOOO24-68-C-0250.

—**Pennsylvania State University,** University Park, Pa. $7,697,000. MK-48 torpedoes. Naval Ordnance Systems Command. NOw 65-0123d-MOD. #13.

—**Bunker-Ramo Corp.,** Silver Spring, Md. $5,620,225. ECM equipment. Naval Air Systems Command. NOOO19-68-C-0210.

—**Curtiss-Wright Corp.,** Wood-Ridge, N.J. $2,843,878. Spare parts for aircraft engines. Navy Aviation Supply Office, Philadelphia, Pa. F41608-67-A-5900-GB89.

—**Raytheon Co.,** South Lowell, Mass. $2,164,913. Guidance and control groups for Chaparral missiles. Naval Air Systems Command. NOOO19-68-C-0102.

15—**LTV Aerospace Corp.,** Dallas Tex. $4,000,000. Long lead time effort for A-7D aircraft. Naval Air Systems Command. NOOO19-67-C-0143.

—**Martin Marietta Corp.,** Baltimore, Md. $3,388,082. Classified work on Navy aircraft. Naval Air Systems Command. NOOO19-67-C-0337.

—**United Boatbuilders,** Bellingham, Wash. $2,250,000. Construction of 39 31-foot river patrol boats. Naval Ship Systems Command. NOO24-68-C-0253.

—**Texas Instruments,** Dallas, Tex. $2,112,376. Components and technical services for radio navigation sets. Naval Ship Systems Command. NOOO24-68-C-1068.

16—**Beech Aircraft Corp.,** Wichita, Kan. $4,678,347. AQM-37A missile targets. Naval Air Systems Command. NOOO19-67-C-0172.

—**Sanders Associates,** Nashua, N.H. $1,746,509. Development work on an ECM system. Naval Air Systems Command. NOOO19-68-C-0085.

—**Westinghouse Electric,** Baltimore, Md. $1,000,000. Increase in the scope of the MK48 Mod O, torpedo test and evaluation program. Naval Ordnance Systems Command. NOw 64-0705-i Mod. #40.

—**Teledyne Systems Co.,** Hawthorne, Calif. $1,175,000. IHAS components. Naval Air Systems Command. NOOO19-67-C-0189.

20—**General Dynamics,** Pomona, Calif. $7,830,714. Standard Arm missiles with shipping containers. Naval Air Systems Command. NOOO19-67-C-0399.

—**General Electric**, Schenectady, N.Y. $4,709,350. Nuclear propulsion research and development. Naval Ship Systems Command. NOOO24-67-C-5016.

—**United Aircraft**, Stratford, Conn. $1,521,600. SH-3D helicopters. Naval Air Systems Command. NOOO19-67-C-0239.

—**Clymer Machine Co.**, Trumbauersville, Pa. $1,281,185. Holding rings and adapters for 5-inch, 38 caliber projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. NOO104-68C-0897.

21—**FMC Corp.**, Minneapolis, Minn. $8,152,810. MK-22 guided missile launching systems and related equipment. Naval Ordnance Systems Command. 00017-67-C-2115.

22—**Raytheon Co.**, Lexington, Mass. $12,635,162. Sparrow III guided missiles and associated equipment. Lowell, Mass. Naval Air Systems Command. N00019-67-C-0029.

—**Sperry Rand**, St. Paul, Minn. $3,956,067. Program tapes for the A-NEW program. Naval Air Systems Command. NOw 66-0613.

—**Westinghouse Electric**, Baltimore, Md. $1,000,000. Production prototype models of special exercise sections for MK-48 torpedoes. Naval Ordnance Systems Command. NOw64-0705-I Mod #44.

—**General Dynamics**, Groton, Conn. $3,000,000. Refueling, overhaul and subsequent testing of the nuclear ballistic missile submarine USS James Madison (SSBN-627). Naval Ship Systems Command. N00024-68-C-0256.

24—**AVCO Corp.**, Cincinnati, Ohio. $3,941,280. Countermeasure sets. Naval Electronics Systems Command. N00039-68-C-0510.

27—**Raytheon Co.**, South Lowell, Mass. $9,254,616. Sidewinder 1C guidance and control sections. Naval Air Systems Command. N00019-68-C00164.

—**Dell Industries**, Waycross, Ga. $2,069,169. MK 76, MOD V practice bombs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68C-3330.

28—**Trustees of Columbia University**, New York, N.Y. $1,741,785. Marine geophysics research. Office of Naval Research.

29—**Sylvania Electric Products**, Mountain View, Calif. $12,722,303. Countermeasure receiving sets. Mountain View and Santa Cruz, Calif. Naval Ship Systems Command. N00024-68-C-1023.

—**North American Aviation**, McGregor, Tex. $8,297,426. Rocket motors for Shrike missiles. Naval Air Systems Command. N00019-67-C-0633.

—**Hughes Aircraft**, Culver City, Calif. $2,275,000. Airborne weapons launchers. Naval Air Systems Command. N00019-68-C-0160.

—**Raytheon Co.**, Portsmouth, R.I., $1,114,300. Maintenance services for sonar systems and conduct of training courses. Naval Ship Systems Command. N00024-68-C-1090.

30—**Simplex Wire & Cable Co.**, Newington, N.H. $4,500,000. Manufacture of undersea cable. Naval Electronic Systems Command. N00039-67-3573.

—**Texas Instruments**, Dallas, Tex. $1,561,807. Equipment for AN/APQ116 radar systems used on A-7A aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-67A-2001-0225.

DEPARTMENT OF THE AIR FORCE

1—**LTV Electrosystems**, Salt Lake City, Utah. $2,292,870. Manufacture of communications test equipment. Oklahoma City Air Materiel Area, (AFLC) Tinker AFB, Okla. AF 34601-67-C-5346.

—**General Electric**, West Lynn, Mass. $1,523,283. Manufacture of components for the control assembly for F-111 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0258.

—**General Motors**, Flint, Mich. $1,782,697. Manufacture of spark plugs for various types of aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF 41608-68-C-0996.

—**Collins Radio Co.**, Richardson, Tex. $1,417,000. Manufacture of airborne antenna components. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 09603-67-C-3177-P001.

—**North American Aviation**, Anaheim, Calif. $1,000,000. Maintenance, repair, overhaul and modification of the Minuteman guidance and control system. Space & Missile Systems Organization, (AFSC), Norton AFB, Calif. AF 04701-68-C-0013.

2—**Philco-Ford Corp.**, Palo Alto, Calif. $8,238,470. Work on communications satellites. Space & Missile Systems Organization, (AFSC), Norton AFB, Calif. AF 04695-67-C-0139.

—**Talley Industries**, Mesa, Ariz. $3,142,500. Production of aircraft engine starter cartridges. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0338.

3—**Fairchild Hiller Corp.**, Farmingdale, N.Y. $1,866,400. Manufacture of modification kits for F-105 aircraft. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. AF 04606-68-J-001.

—**Analytical Services, Inc.**, Falls Church, Va. $1,494,700. Analytical studies pertaining to the application of weapons systems. Air Force Office of Scientific Research. AF 49-638-1259.

6—**Lear Siegler**, Grand Rapids, Mich. $3,749-524. Manufacture of airborne electronics equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-67-C-0979-P002.

—**LTV Electrosystems, Inc.**, Greenville, Tex. $11,706,953. Inspection, repair and modification of C-121 aircraft. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. AF 04606-68-C-0331.

—**Aerodex, Inc.**, Miami, Fla. $4,199,944. Overhaul of aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF 41608-68-D-0616.

7—**Spacecraft Inc.**, Huntsville, Ala. $1,754,000. Work on the Titan II instrumentation system. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. 04 (695)-1053.

—**Goodyear Tire & Rubber Co.**, Akron, Ohio. $3,224,725. Manufacture of wheels and brakes for C-130 aircraft. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. 33657-67-A-0038-0P40.

—**Applied Technology of ITEK Corp.**, Palo Alto, Calif. $2,101,523. Manufacture of airborne radar components. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga.

8—**Boeing Co.**, Renton, Wash. $15,000,000. Four 707-320C jet aircraft for the German Air Force. Aeronautical Systems Div. (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0208.

13—**General Electric**, Syracuse, N.Y. $2,726,150. Manufacture of height-range finder antennae. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. AF 34601-67-A-1470.

—**Hallicrafters Co.**, Chicago, Ill. $1,659,881. Production of spare parts for electronic counter-measure equipment. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 33 (657)-15751.

14—**Continental Aviation & Engineering Corp.**, Detroit, Mich. $4,624,672. Production of J-69 engines. Toledo, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0053.

15—**Quiller Construction Co.**, Los Angeles, Calif. $1,912,600. Construction of 124 family housing units at Vandenberg AFB, Calif. Base Procurement Div., Vandenberg AFB, Calif. AF 04684-68-C-0069.

16—**Straza Industries**, El Cajon, Calif. $9,833,924. Manufacture of bomb fin assemblies and related data. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF BOA-F04606-68-A-0011-2P0I.

—**Continental Aviation and Engineering Corp.**, Detroit, Mich. $1,649,646. Target drones. AF 33657-68-C-0037. $2,081,983. Army drones. Toledo, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF-33657-68-C-0244.

17—**American Electric, Inc.**, La Mirada, Calif. $1,478,215. Production of fuze assemblies for aircraft ordnance. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 42600-68-C-1169.

—**Maxson Electronics Corp.**, Macon, Ga. $1,405,098. Production of fuze assemblies for aircraft ordnance. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 42600-68-C-1524.

—**United Aircraft**, East Hartford, Conn. $1,016,201. Manufacture of spare parts for J-57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF N383-69000A.

20—**Honeywell, Inc.**, Hopkins, Minn. $9,655,400. Manufacture of aircraft bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0593.

21—**Hayes International Corp.**, Birmingham, Ala. $2,265,700. Production of aerial tow targets. Air Proving Ground Center, (AFSC), Eglin AFB, Ala.. 08651-68-C-0211.

22—**Martin Marietta**, Denver, Colo. $88,632,664. Design, fabrication, assembly, test and delivery of Titan 111D space boosters and associated ground support equipment. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF 04695-67-C-0041.

—**McDonnell Douglas Corp.**, St. Louis, Mo. $1,571,850. Engineering services, trial installation and flight testing of airborne camera equipment. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 34601-67-A-2188-OPDU.

—**General Electric**, West Lynn, Mass. $1,111,998. Manufacture of spare parts for T-64 aircraft engines. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. AF 3657-67-C-0054.

—**Goodrich Co.**, Akron, Ohio. $1,062,000. Production of aircraft tires. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 42600-68-D71801.

—**RCA**, Burlington, Mass. $7,276,500. Engineering and production of transportable communication control centers. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass. AF 19628-68-C-0069.

27—**American Electronic Laboratories**, Colmar, Pa. $1,170,000. Manufacture of electronic countermeasure equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

29—**Hycon Mfg. Co.**, Monrovia, Calif. $1,355,000. Manufacture of airborne camera equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-67-C-0470-P003.

—**Itek Corp.**, Palo Alto, Calif. $1,184,080. Production of airborne radar components for F-4 aircraft. Warner-Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 04606-67-A-1818.

—**Sanders Associates**, Nashua, N.H. $1,050,000. Manufacture of airborne countermeasure receiver subsystems. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0079-P001.

30—**M.I.T.**, Cambridge, Mass. $32,995,000. Research & development of advanced electronic programs. Lexington, Mass. Electronic Systems Div., (AFSC), L.G. Hanscom Field, Mass. AF 19 (628) 5167.

—**Quantic Industries**, San Carlos, Calif. $1,278,651. Development, fabrication and qualification of a prevision horizon sensor system. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF 04701-68-C-0064.

OFF-SHORE PROCUREMENT

8—**United Aircraft of Canada, LTD**, Longueuil, Quebec. $1,292,140. Spare parts for R-4360 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex.

20—**Litton Systems, Canada, Ltd.**, Rexdale, Ontario, Canada. $2,146,180. Weapons release system AN/ASQ-91 applicable to F-4 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

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Defense Industry Bulletin Passes 20,000 Subscribers on Third Anniversary

The current issue of the *Defense Industry Bulletin* marks the beginning of its fourth year of publication.

Three years ago the *Bulletin* came into being with a distribution list to 1,100 subscribers in industry, who had responded favorably to a survey letter asking whether or not such a publication would be useful to them. The growth of the *Bulletin* has maintained a steady progress and now is being distributed to over 20,000 subscribers.

The breakdown of the distribution list, in round figures, is as follows:

Industry (including trade association, trade publications, labor organizations, etc.)	14,000
Educational Institutions	1,500
DOD and Other Government Agencies	4,500

The staff of the *Bulletin* is very appreciative of the thousands of letters received in three years of existence. We pledge ourselves to continue the job of making this publication one that will be of maximum service to our readers.

The Editor

Patent Abstracts Journal Publication Begins in January

Beginning Jan. 2, the U. S. Department of Commerce Patent Office will publish a weekly journal containing abstracts and drawings of U. S. patents.

The objective of the journal is to provide non-patent oriented scientists, engineers and businessmen easier access to the important technical information contained in patents. For this purpose, abstracts have been required as part of patent applications since Jan. 1, 1967.

The abstracts take the place of "claims" in the Patent Office's *Official Gazette*, and the new journal is an extract from the patent section of this publication. The *Official Gazette* will continue to best serve the patent practitioner.

The new *Official Gazette Patent Abstracts Section* is being offered on a six-month basis (January through June 1968) by the U. S. Government Printing Office, Washington, D. C. 20402, for $27. Regardless of date of subscription entry, the full price will be charged and back issues will not be furnished. Single copies will be sold for $1.25 each.

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